

**Environmental  
Status and Trends  
in the Southeast  
2000**



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## A Report from the Southeast Natural Resource Leaders Group



U.S. Forest Service



National Park Service



The Tennessee Valley Authority



Natural Resources Conservation Service



U.S. Fish & Wildlife Service



U.S. Geological Service



U.S. Environmental Protection Agency  
Region 4



U.S. Department of Defense

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A vibrant field of yellow wildflowers stretches across the background. In the foreground, a dark tree trunk is visible on the left, and a branch with green leaves extends from the left towards the center of the frame.

## **Our Southeastern Environment**

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The Southeast is a special place. Rich and diverse, with beautiful and varied coastlines, it has more miles of rivers than any other region and more of the country's remaining wetlands. It also contains five million acres of Southern Appalachian national forests and parks — the largest contiguous tract of public land in the eastern U.S.





However, as we enter the 21st century, the Southeast faces some enormous environmental challenges. It's the fastest growing region of the country, with the most miles of new road construction. Miami and Atlanta are among the nation's top 10 sprawling cities, and Atlantans drive more miles per day than most other Americans. Although growth has brought us unparalleled prosperity, it's also placing unprecedented pressures on our environment and natural resources. Air and water quality are declining and we're continuing to lose the special places that make our region unique.

**The Choices** The Southeast Natural Resource Leaders Group (SENRLG) is an informal alliance of senior federal executives who have chosen to respond to our region's new challenges collaboratively. By leveraging our combined resources, we're working to achieve clear and measurable improvements in the condition of our natural resources. We're committed to engaging the public more effectively and operating more creatively and flexibly within our individual agencies to meet specific natural resource and environmental goals.

This report presents some of today's environmental issues against a backdrop of current and past economic and societal trends. It also highlights some of the promising solutions emerging throughout our region, and serves as the basis for future status updates to the public by federal resource agencies

The report uses a set of *environmental indicators* to explore the status of some of our region's most important natural resources. Indicators are bits of information that help to inform us quickly and easily about the status of the environment and complex environmental issues. Indicators are often designed to measure or quantify current environmental conditions, or changes or trends over time. They can focus directly on the quality of the environment itself, on factors influencing environmental quality, or on other issues that are the direct result of changes in environmental quality.

We have selected a limited number of indicators to report because, of course, it isn't possible to measure everything. By the same token, indicators, by their very nature, do not tell the whole story concerning complex issues. Rather, they are meant to supply "snapshots" of aspects of environmental health at a given time and place that help us understand a few specifics and encourage thoughtfulness about the big picture.

Protecting and preserving our environment and natural resources is everyone's business. We hope this report helps spark your interest and provides ideas for your participation in protecting our environment.





# The Southeast





Catfish, cotton fields, grits, and backwater swamps. These are the long-held images of the Southeast. But we're much more . . . globally significant natural resources, fast growing cities, and world-class goods, services, and industries. These qualities shape our regional heritage and are attracting people to the Southeast in ever-increasing numbers — compelling reasons to protect resources through effective environmental management.

This report focuses on the nine Southeastern states: Virginia, Kentucky, North Carolina, Tennessee, South Carolina, Georgia, Alabama, Mississippi, and Florida. Within these states, we have more wetlands, more forests, and more miles of rivers, but also a higher growth rate, than any other region in our nation.

**The elaborate river systems of the Mississippi, Ohio, Tennessee and Savannah River basins afford great opportunity for the transport of goods.**





### Outstanding Natural Resources

The Southeast developed primarily as an agrarian economy, taking advantage of the flat alluvial plains, mild winters, and abundant rainfall, and continued its agrarian lifestyle well into the 20th century. Livestock grazing also has a long history in our region. Revenues from hogs, cattle, and poultry have accounted for over half of the farming income for some of our states. Our great Southeastern forests have traditionally supplied raw materials and income. Timber, pulp, and paper have been important industries here for more than a hundred years.

The Southeast boasts some of the most unique natural resources in the country and in the world:

- ◆ The Florida Everglades is the second largest wetland in the world.
- ◆ The Great Smoky Mountains are known worldwide for extraordinary biological diversity.
- ◆ The only barrier reef in North America is located off the coast of Florida.
- ◆ The Okefenokee is one of the largest blackwater swamps in North America.
- ◆ Thirty-five percent of all wetlands in the lower 48 states are in the Southeast.

But the Southeast is also home to some of the most distressing natural resource concerns:

- ◆ Twenty percent of the Nation's endangered ecosystems occur in the Southeast. Our Southeastern states are among the top 15 states nationally with the most federally listed threatened or endangered species.
- ◆ Nearly 50 percent of all documented species extinctions in the U.S. since European settlement have occurred in the Mobile River Basin in Alabama.







## A Region of Diversity: A Region at Risk

Our region may have no more distinctive attribute, ecologically speaking, than the extraordinary diversity of fish and other aquatic species inhabiting its fresh waters — lakes, springs, streams, and rivers. In fish, mussels, and crawfish, for example, the Tennessee-Cumberland ecoregion is the most species rich in North America.

That's the good news. The bad news is that this incredible natural richness has been disturbed by every category of threat to flowing water systems: impoundment, channelization, pollution, and rapid urbanization. Hydrological alterations, such as dams, levees, and channel straightening, have left their mark on practically every stream in the Mississippi River Valley.

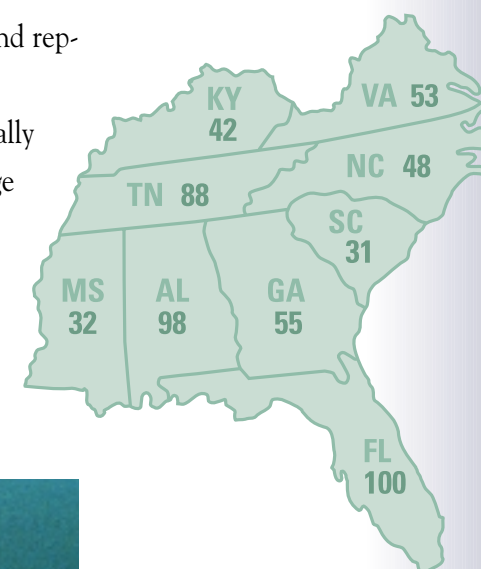
Our region's biodiversity doesn't stop at the water's edge. The Southeast is also home to a diverse collection of *terrestrial*, or land-based, species, from large mammals to isolated pockets of rare plants.

The Mississippi and Atlantic flyways cross the region, providing critical stopover, breeding, and wintering habitats for millions of migrating waterfowl, songbirds, and predatory birds each year. For example, the wetlands of the Gulf Coast provide wintering habitat for more than 400,000 geese and 3 million ducks.

The types and numbers of amphibians and reptiles in the Southeast are unrivaled anywhere on the continent north of Mexico. Approximately 290 species of amphibians and reptiles are found here.

Such diversity of animals is dependent on equally diverse plant communities. In our region, they range from the vast hardwood forests of the Appalachian Mountains, to the isolated Carolina Bays of the coastal plain, to the rapidly disappearing cypress swamps. The Everglades alone is home to 25 species of orchids, more than 1,000 species of seed-bearing

### Number of Threatened and Endangered Species





**Exotic species cost us  
\$123 billion annually!**

**Some of the costs:**

- ◆ \$6.5 billion related to disease-causing organisms
- ◆ \$20 billion related to foreign insects
- ◆ \$35.5 billion related to alien weeds



plants, 120 species of trees, and more than 300 species of birds.

Unfortunately, terrestrial ecosystems are facing many of the same threats that confront aquatic communities across the region. Pollution, rapid urbanization, and habitat fragmentation are changing the landscape and threatening the natural balance upon which they depend.

**Invasion!** “Exotic” organisms, meaning organisms that have permanently established in ecosystems to which they are not native, are devastating our natural resources. Though some introductions of exotic species are accidental

and initially escape our attention, many exotic species are intentionally brought in, including some of the most widely recognized plants in the Southeast today. Kudzu, the omnipresent vine blanketing our pine and hardwood forests, was originally introduced in 1876 as an ornamental plant and was later used for erosion control. Similarly, two fast-growing trees, *Melaleuca* and Brazilian pepper, which were introduced for landscaping, are now threatening the Florida Everglades.

But plants aren’t the only invaders. For decades, we’ve stocked waterways with non-native fish species for sport and

**Today, kudzu is slowly smothering many of our region's forested areas.**



Jack Rose, photographer



Growth and human-introduced changes in the Southeast have taken their toll on our natural resources. Here are just a few of the sobering statistics:

- ◆ Loss of 98 percent of our longleaf pine forests by 1986
- ◆ Seventy-eight percent reduction in pre-settlement bottomland, hardwood forests
- ◆ Loss of 28 percent of all pre-settlement wetlands in the coastal plain by 1986
- ◆ Loss of 15 percent of our Atlantic and Gulf coastal barrier island habitat by 1975 due to urbanization.



consumption. Some of the impacts are as straightforward as larger, exotic fish preying on the smaller, native fish species, or zebra mussels in the Cahaba River basin competing with native species for food. Other impacts are much more complicated. For example, grass carp, which have been used to control aquatic vegetation, can alter the complex food web upon which an entire aquatic ecosystem depends.

Other exotic species can directly threaten human health. University of South Florida researchers have found “vast colonies” of human viruses that regularly migrate into coastal waters from septic tanks, infecting shellfish and threatening human swimmers as well. About 40 percent of the Florida shrimp studied carried viruses that affect humans.

Changes such as warmer water temperatures may encourage new species, including viruses, which can better tolerate the warmer environment. Warmer water is being blamed for the development of devastating parasitic oyster diseases along the Eastern Seaboard, where oyster harvests plummeted from millions of bushels annually to an all-time low of about 14,000 bushels in 1998.

**And What About People?** Our population’s overall health can be compared to the rest of the country’s by evaluating the rates of several major health conditions. The news isn’t good. Age-adjusted mortality rates due to all cancers, stroke, and other lung and respiratory diseases have all been high in the Southeast.

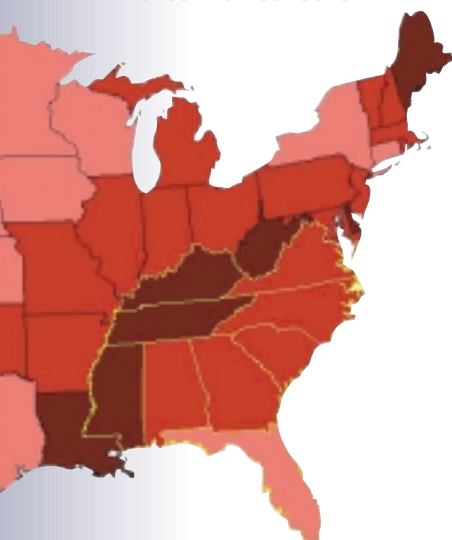
Wetland Losses

State	Net Change in Wetlands Mid 1970s - Mid 1980s Thousands of acres
Alabama	-42
Florida	-260
Georgia	-78
Kentucky	*
Mississippi	-209
North Carolina	-1,199
South Carolina	-61
Tennessee	-25
Virginia	*

\*NOTE: not determined for KY and VA.



Age-adjusted mortality  
rates – all cancers



Per 100,000

Light pink	137-162
Red	163-190
Dark red	191-208
Very dark red	209-223

## Inequities in the Distribution of Environmental Hazards

**A**lthough lowered environmental quality affects everyone, low-income, minority, and/or culturally diverse communities have historically been disproportionately impacted by environmental hazards. Examples include:

**Waste Sites:** Communities with hazardous waste incinerators typically have large minority populations, low incomes, and lower property values. Nationally, communities with waste incinerators have an almost 90 percent higher minority population and almost 40 percent lower property values than

average. Communities proposed as incinerator sites have a 60 percent higher minority population and 35 percent lower property values than average.

**Agricultural Runoff:** Streams and rivers in rural areas with concentrations of commercial truck farms and animal feedlots have developed algal blooms and fish kills due to oxygen depletion. Elevated use of commercial fertilizers and concentrations of animal waste are the likely causes. Rural communities often have higher low income and minority populations.

**Pesticides:** Approximately 90 percent of the two million farm workers in the U.S. are people of color, including Chicanos, Mexican migrant workers, Puerto Ricans, Caribbean blacks, and African Americans. Through direct







exposure to pesticides, farm workers and their families may face serious health risks. As many as 313,000 farm workers in the U.S. may suffer from pesticide-related illnesses each year.

**Sewer Overflows:** Modern sewage systems are designed to carry sewage and stormwater separately to prevent overflow problems. But many inner cities, which are often occupied by lower income and minority residents, still have older, combined systems. When overflows occur during storms, raw sewage may be carried into local rivers and streams, creating a health hazard.

**Lead:** Although the use of lead paint for houses was banned in the 1970s, many older homes still contain old, leaded paint, lead soldering in water pipes and fixtures, and lead in dust and soils. Lead problems are particularly high in low-income and

culturally diverse, inner city neighborhoods with public housing units built before 1970.

**Air Pollution:** Though they're less likely to own a car, low income people and people of color are more likely to live in urban areas, which means they are disproportionately impacted by reduced air quality. Asthma, an emerging epidemic aggravated by air pollution, is more prevalent in minority populations. Children are particularly at risk. Asthma is currently the most common chronic disease of childhood and affects almost five million children under the age of 18.





# Economic Sectors



**T**he Southeast has also long been known for its natural abundance in forests, minerals, and coastal fishing resources. Forestry-related industries (including lumber, paper mills, and furniture production); agricultural products; coal and petroleum extraction; and the tourism that flourishes along our coasts, mountains and waterways are all part of our economic heritage.

While much has changed in the Southeast over time, our reliance on the land and natural resources for our economic vitality has not. World War II catapulted industrial growth in the Southeast, with conversion of many government-owned lands to military bases for training, weapons manufacture, and in later years, support for the space program. The military's presence here is greater than in any other region of the country, and because of its presence, private-sector support and manufacturing businesses have also made the Southeast their home. In addition to playing a key role in advancing the military's mission, Southeastern military facilities also contribute significantly to the region's economy. For example, the Department of Defense contributes about \$15.4 billion annually to Georgia's economy alone.



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**The Manufacturing Sector** Significant land area in the Southeast is dedicated to resource harvesting. Despite this fact, direct revenues from agricultural and forest harvests, combined with commercial fisheries harvests, are only two to three percent of our states' Gross State Product (GSP). Much more significant is the “agribusiness” or product-processing industries the resource harvests support. Food processing, typically meat, baked goods, and fruits and vegetables, is economically dominant in all of our states except Alabama and South Carolina.

Textiles industries have traditionally thrived in North Carolina, South Carolina and Georgia, due to the proximity of raw materials — especially cotton. Today, textile manufacturing is still economically significant in the Carolinas, Georgia, and Virginia, although it's heavily supported by chemical and synthetic fiber manufacturing.





## Federal Lands and Facilities

Federal lands are a significant ecological resource in the Southeast. Our abundant national parks, forests, and recreation areas provide places for people to renew their acquaintance with nature, and for nature to renew itself in a cycle uninterrupted by human activity. In addition to the lands specifically set aside for preservation and recreation, however, are millions of acres administered by the Departments of Defense (DoD) and Energy (DoE). The DoD has a greater presence in the Southeast than in any other region of the country: 18 major Army installations, 21 major Air Force installations, over 30 Naval bases, 7 Marine Corps bases, and over 900 reserve and National Guard centers. Ranging in size from 100 acres to over 460,000 acres, most of the acreage at the larger facilities is open space that preserves significant ecological resources. They also provide safe havens for threatened or endangered species. For example, through the *Private Lands Initiative* in North Carolina, military lands are playing a principal role in the recovery of the endangered red-cockaded woodpecker.

The DoD conducts preservation programs to comply with such environmental laws as the *National Environmental Policy Act* and the *Endangered Species Act*. Nearly all of our larger federal properties have at least one rare, threatened, or endangered species —

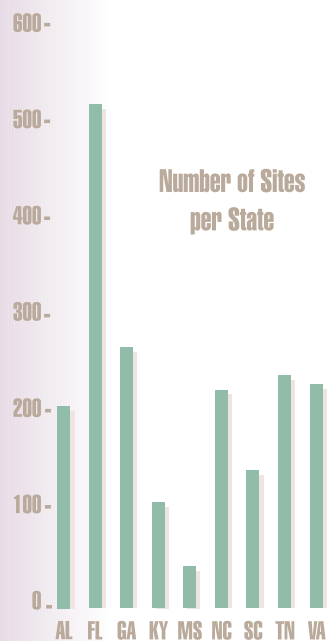
and in some cases, as many as 12. Operational and training activities related to the facilities' missions must be coordinated to ensure minimal impact to sensitive habitats and resources. In addition, facilities conduct land management activities that range from agricultural and grazing leases and timber harvests, to watershed management and ecosystem restoration.

Unfortunately, the very operations that are the basis for the defense facilities' existence have contaminated the environment, often with significant impacts. Years of mis-handling toxic materials and wastes have left their legacy in soils, sediments, groundwater, and surface waters. However, in partnership with federal and state environmental agencies, facilities are not only cleaning up the environment, but pioneering new ways of handling and disposing of hazardous materials, and developing new systems that minimize the future need for such materials. An excellent example is the "Green Bullet," which is lead free. The new bullet not only meets required performance criteria in tests, but slightly exceeds the old bullet's performance.





### Unpermitted or Abandoned Hazardous Waste Sites Currently Under Investigation for Cleanup



**Growth Sectors** In recent years, the automobile manufacturing sector has moved to the Southeast, bringing with it parts manufacturing suppliers. In 1980, Toyota opened an assembly plant in Kentucky, and by 1989, an additional 80 parts manufacturing facilities had opened there. Tennessee is now home to Saturn and Nissan plants; South Carolina has BMW; Alabama has Mercedes-Benz, Honda, and Navistar (truck manufacturing); and Georgia has General Motors and Ford.

Motor vehicles, primary metals, and fabricated metals are economically significant industrial sectors in Alabama, Kentucky, South Carolina, and Tennessee. Electronics manufacturing has also grown, largely in support of auto manufacturing, as well as to support space industry needs and the burgeoning communications and other “high tech” sectors increasingly attracted to the Southeast.

**Industrial Pollution** What impacts do industries have on our environment? Current estimates suggest three sectors are responsible for about 96 percent of all the reported chemical releases into water: crude petroleum and natural gas, publicly owned sewage treatment plants, and federal or military facilities. It’s important to note that

◆ Robins Air Force Base in Georgia recently received the Governor's Award for pollution prevention for reducing its use of toxic chemicals by 88 percent and generating \$790,000 in annual savings.

these sectors provide us with some of our most critical and basic utilities and services.

As for air pollution, just five industrial sectors account for half of the total amount of chemicals released into the air from regulated industries — with 18 percent attributable to the plastic materials and synthetic fibers industry alone. The other four top contributors are pulp mills, miscellaneous plastic products, paperboard mills, and industrial organic chemicals. However, it’s important to note that in many urban areas, vehicle emissions are the most significant source of toxic chemicals released into the air.

◆ The Saturn Corporation plant in Tennessee is a national model for pollution prevention, because of its plant design and because it sets high pollution prevention standards for all of its suppliers.



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**Pollution Prevention** With the increased popularity of the Sunbelt and the growing emphasis of our state and local governments on economic development, more and more businesses are locating here. Many of these businesses, even when operating in full compliance with existing environmental laws and regulations, will use and dispose of small quantities of toxic substances. Though individually small, those quantities will cumulatively amount to hundreds, if not thousands, of additional pounds of chemicals in the environment. That's why *Pollution Prevention* (or  $P^2$ ) is critically important. As a philosophy and practice, it goes beyond mere compliance

**Pounds of Toxic Chemicals Released into the Environment  
in 1998 by Regulated Facilities**

State	# Facilities	Lbs. Released to the Air	Lbs. Released to Surface Waters	Lbs. Released to Landfills	National Rank for Total Onsite & Offsite Toxic Chemical Releases
AL	563	82,870,794	5,032,032	12,779,703	12
FL	603	89,866,333	2,116,926	936,137	13
GA	774	93,901,227	6,426,876	238,189	19
KY	468	75,613,690	1,401,436	485,535	22
MS	342	44,744,965	11,388,138	6,703	25
NC	877	93,413,992	7,395,637	1,335	17
SC	509	57,105,923	3,351,638	5,181,267	20
TN	691	104,821,484	1,797,975	137,736	15
VA	496	62,898,167	5,352,544	104,229	24

with environmental laws and regulations to achieve continuous reductions in the amounts of waste generated and released into the environment. At the same time, businesses operate more efficiently and save money. For example, the recent shift towards automobile manufacturing in the Southeast brought the opportunity to incorporate state-of-the-art facilities and P<sup>2</sup> technologies into operations from the outset.

**P<sup>2</sup> Successes in the Carolinas** Federal and state efforts have resulted in a number of innovative P<sup>2</sup> successes in our region. The State of North Carolina, for exam-

ple, in conjunction with the Environmental Protection Agency's *Common Sense Initiative*, held P<sup>2</sup> training sessions and provided assessments in three of its cities. The sessions targeted metal finishers who dispose of their wastes in municipal sewer systems. They were shown ways to reduce or virtually eliminate heavy metal wastes. The metals often entered nearby streams after passing through a sewage treatment plant, or they accumulated in the *sludges* produced by the sewage treatment process. The voluntary P<sup>2</sup> measures not only prevented the chemicals from ever reaching the waterways or sludges, but also demonstrated how money,

**Service sectors in the Southeast now collectively contribute two-thirds to three-quarters of the revenue in our states.**





materials, and operating costs could be saved.

In South Carolina, the Medical University of South Carolina and the State's P<sup>2</sup> technical assistance program instituted a program of P<sup>2</sup> assessments and training for hospitals throughout the state. Medical waste incinerators are a significant source of mercury pollution into the atmosphere. Once it's in the atmosphere, mercury can be re-deposited in rivers and streams, leading to contamination of the water, sediments, and fish tissues. The South Carolina program is showing hospitals how to segregate their mercury-contaminated waste from their other waste, dispose of it properly,

and minimize the use of mercury in day-to-day operations through product substitutions. Medical instruments and equipment such as thermometers and blood pressure manometers that have traditionally contained mercury are being substituted for non-mercury alternatives.

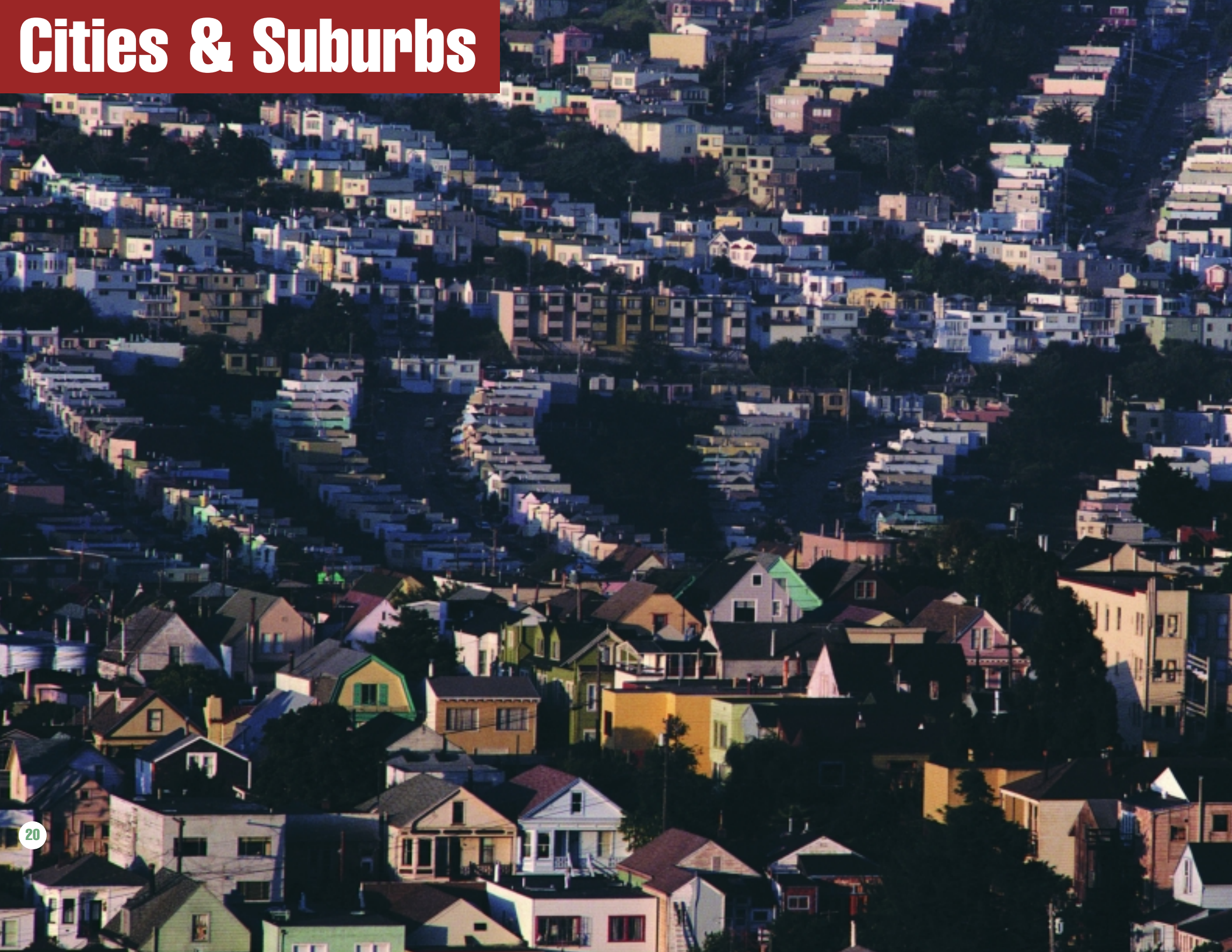
**Service Sectors** Economic change in the United States has traditionally followed a progression from an agriculture-based economy, to a manufacturing-based economy, to a service-based economy. That pattern holds true for the Southeast, where service sectors now collectively contribute two-thirds to three-quarters of the revenue in our states. Service sectors are all the businesses that aren't natural resource, construction, or manufacturing based. They include hospitality, tourism, financial, and real estate businesses; automobile dealerships; grocery stores; gas and service stations; wholesale and retail establishments; and restaurants. Auto-related services, for example, occupy one or more of the top three positions of economic significance in each state.

It's difficult to make direct comparisons between contributions of toxic contaminants from regulated industries and pollution from non-regulated or diffuse sources (such as private automobiles or pavement runoff). Although they've traditionally been considered "clean" businesses, a proliferation of services can have indirect, negative impacts on our environmental. Those impacts are intricately linked to the land development practices in the places where most services are provided: cities and suburbs.





# Cities & Suburbs





**M**ost of the Southeast remained rural through the turn of the 20th century. In the 1940s, industries such as manufacturing (textile and metals), pulp and paper mills, mining, and chemical operations began to diversify the region's agricultural economy. By the 1960s and '70s, major corporations were headquartering their businesses here, and the "New South" was born. Cities boomed and immigration from other parts of the country increased like never before. The Southeast's economy finally began to catch up with the nation's.

**Urban Growth** During the 1930s and '40s, millions of people moved from rural areas to the big cities in search of new jobs. But this new immigration quickly reversed. By the '50s, a combination of overcrowded, in-town housing and growing incomes, coupled with the infamous "baby boom" that followed World War II, prompted families to seek larger homes on larger lots, away from the congestion of the cities. Migration of racial and ethnic minorities into central cities during the 1950s and '60s was also an impetus for many white families to move to the suburbs. Nationally, growth was 10 times higher in the suburbs than in cities, and by 1970, for the first time in U.S. history, more people lived in the suburbs than in cities or on farms.



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A 1994 national ranking by *Inc.*, Magazine placed 6 out of the top 10 best cities for business in the Southeast, and *Fortune* Magazine ranked Miami and Atlanta in the top 10 worldwide. Charlotte, North Carolina, became the third most important banking center in the U.S. in the 1990's.

Urban growth has brought many positive changes to the Southeast, including the diversification of our population and economy, but there have been costs to the environment. When land is developed, native plant communities and wildlife habitats are removed or fragmented. They are replaced by impervious surfaces such as pavement, roads,



parking lots, and rooftops — areas where rain water cannot infiltrate into the ground. Water “runs off” these surfaces and eventually enters nearby waterways via storm sewers, carrying a host of pollutants. Motor oil and various other petroleum products, dirt and silt, litter and debris, and a

wide variety of pesticides are the most common. Runoff from impervious surfaces may also be heated to an extent that is harmful to trout and other temperature-sensitive species in streams. Scientists have found that when the proportion of impervious surfaces in a watershed exceeds 10 percent, streams in that watershed are almost certain to develop poor water quality.

Urbanization also brings . . . *people!* . . . in greater numbers and densities, driving cars, burning energy, using various chemicals and other products, and disposing of wastes. And because of the nature of human activities, impacts extend far beyond the immediate footprint of the urban area. The net result for the environment is deteriorated air and water quality, and an irreversible loss or displacement of the native biota.

**Sprawling Growth** Many land development impacts appear inevitable and unavoidable, but this isn’t true of the impacts associated with exceedingly rapid, poorly planned, or unrestrained growth. The word “sprawl” is used to describe low-density, retail-based, car-dependent development located farther and farther away from historical urban centers. Sprawl occurs when the rate at which open land is consumed greatly exceeds the rate of population growth.

Atlanta has been called the fastest growing city ever in the history of civilization. Metropolitan Atlanta nearly doubled in size in the 1990s, going from about 65 miles



from north to south in early 1990, to 110 miles by the end of the decade. According to the U.S. Census Bureau, Atlanta is now the least dense of all major U.S. metropolitan areas (approximately 1,366 persons per square mile). Atlantans are among the people in the nation who do the most driving — an average 37.3 miles per day per man, woman, and child.

**Impacts of Sprawl** The impacts of sprawl are far-reaching and include the following: increased traffic congestion and a more hectic pace of life; a lost sense of community for suburbanites and rural residents; loss of rural scenic beauty; deterioration of inner city infrastructure and economic vitality; a prevalence of abandoned, aged industrial

The consequences of sprawl on the environment are devastating:

- ◆ Loss and fragmentation of rare and sensitive wildlife habitats
- ◆ Loss of farms, open spaces, and forested lands to urban development
- ◆ Increased runoff of toxic pollutants into waterways from impervious surfaces, and increased sediment erosion from construction sites
- ◆ Deteriorated air quality due to over-dependency on automobiles

properties in inner cities; and increased taxpayer burden due to the high cost of constructing and expanding utilities farther and farther from the historic urban core.

The environmental pollution stemming from sprawl



Vehicle Miles Traveled  
(1997) for Selected  
Southeastern Cities

City	Average Miles Traveled Daily per Man, Woman & Child
Atlanta, GA	37.3
Birmingham, AL	33.5
Charlotte, NC	29.0
Columbia, SC	25.4
Fort Lauderdale-Hollywood- Pompano Beach, FL	23.3
Jackson, MS	26.5
Louisville, KY	28.5
Miami, FL	18.2
Nashville, TN	35.7
Orlando, FL	27.0
Raleigh-Durham, NC	31.3
Richmond, VA	26.2

isn't always easy to quantify or directly measure, and many of the pollution sources can't be controlled through conventional, environmental regulatory programs.

One effect that *has* been measured is the impact sprawl is having on urban temperatures. NASA scientists discovered that when Atlanta suburbs expanded and eliminated 350,000 acres of forest between 1973 and 1998, the city grew hotter by eight to 10 degrees. Dark roofs, streets, parking lots, and other pavements in urban areas act as giant solar panels, soaking up sunlight during the day and releasing heat at night. This phenomenon, known as the "urban heat island effect," is so dramatic it can trigger the formation of summer thunderstorms over urban areas. Today, the



greater Atlanta area continues to lose tree cover at a rate of about 50 acres per day.

Air Pollution: Product of a Car Society

Driving a personal car is probably the average person's most polluting daily activity, and several of our region's cities are now struggling under burdens imposed by the resulting compromised air quality. Since 1970, Americans have increased their driving 100 percent, and more than a quarter of the vehicle miles traveled on our roads today are associated with employee commute trips.

Since the 1960s, auto emissions have gotten increasingly cleaner. Today's vehicles emit 70 percent less *nitrogen oxides* (NOx) and 80 to 90 percent less *volatile organic compounds* (VOCs). But pollution from growing vehicle use and traffic congestion threatens to offset and overwhelm the air quality benefits of today's cleaner cars and fuels. Trucks, buses, and cars idling in traffic waste billions of gallons of fuel and emit millions of tons of pollutants each year, which contribute significantly to smog formation.

Pollution from cars comes from byproducts of the combustion process, as well as from evaporation of the fuel itself. The major component of smog formed from these processes is *ozone*: an odorless, colorless gas. Ozone in the upper atmosphere occurs naturally and protects life on earth by filtering out ultraviolet radiation. Ground level ozone, which forms when other pollutants, NOx and



# Personal Choices

It's become common knowledge that automobiles are the primary source of certain kinds of air pollution, and individual driving habits can make a big difference in how much pollution your car produces:

- Avoid unnecessary idling. Gas can be saved by turning the engine off if you'll be idling longer than 30 seconds.
- Avoid stop and go driving. Plan to make your trips outside of rush hour and peak traffic periods.
- Avoid using your air conditioner. It increases the load on your engine, which increases emissions and reduces fuel economy.
- Avoid spilling gasoline when you go to the pump. Spilled gas pollutes the air when it evaporates.

These strategies, plus avoiding unnecessary driving, following your car manufacturer's recommended maintenance guidelines, and driving responsibly will all help to reduce emissions. But the most effective way to reduce your car's emissions is to make lifestyle choices that enable you to drive less!

VOCs, react with sunlight, is harmful to humans and ecosystems. People most at risk from exposure to ground level ozone are children, adults who are active outdoors, and people with respiratory diseases. Ozone is responsible for the choking, coughing, and stinging eyes we've come to associate with smog.

When inhaled, even at low levels, ozone can

- ◆ Cause acute respiratory problems
- ◆ Aggravate asthma
- ◆ Cause temporary decreases in lung capacity of 15-20 percent in some healthy adults
- ◆ Cause inflammation of lung tissue
- ◆ Lead to hospital admissions and emergency room visits related to respiratory illness
- ◆ Impair the body's immune system defenses
- ◆ Cause cancer, and reproductive and neurological problems

.....

## Areas that Violated the Ozone Standard in 1999

City	Number of Days in 1999 Above Legal (1-Hr.) Standard
Atlanta, GA	23 days
Birmingham, AL	3 days
Louisville, KY	1 day

.....

**The United Nations Conference on Environment and Development (UNCED) defined sustainable development in 1992 as:**

*“development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”*

**Sustainable Development: The Alternative to Sprawl** State and federal agencies have made tremendous progress over the past few decades in solving major pollution problems. But even if we enforced every environmental regulation currently on the books to the fullest extent, continued sprawl would still make it impossible to pass on to our children an environment of the quality we’ve enjoyed. That’s why “Sustainable Development” is so important. Sustainable Development is a strategy that makes a positive connection between protecting the environment and supporting social and economic development. Sustainable communities act to improve their overall quality of life.

A closely related concept, “Smart Growth,” focuses on managing sprawl while improving total quality of life. It involves finding new sources of economic vitality for rural towns and counties; preserving scenic beauty and other environmental assets of open spaces; creating livable, new communities; and rejuvenating decaying cities and older suburbs.

**Revitalizing Abandoned Properties** Cities are full of abandoned properties, called “Brownfields,” which were previously sites of industrial operations. Purchasers and lenders are wary of acquiring them because of the additional cost and liability they could pose during development if they’re found to be contaminated. EPA’s *Brownfields Initiative* reduces some of the risks associated with acquiring these sites by assisting communities with assessment and clean up. Through this

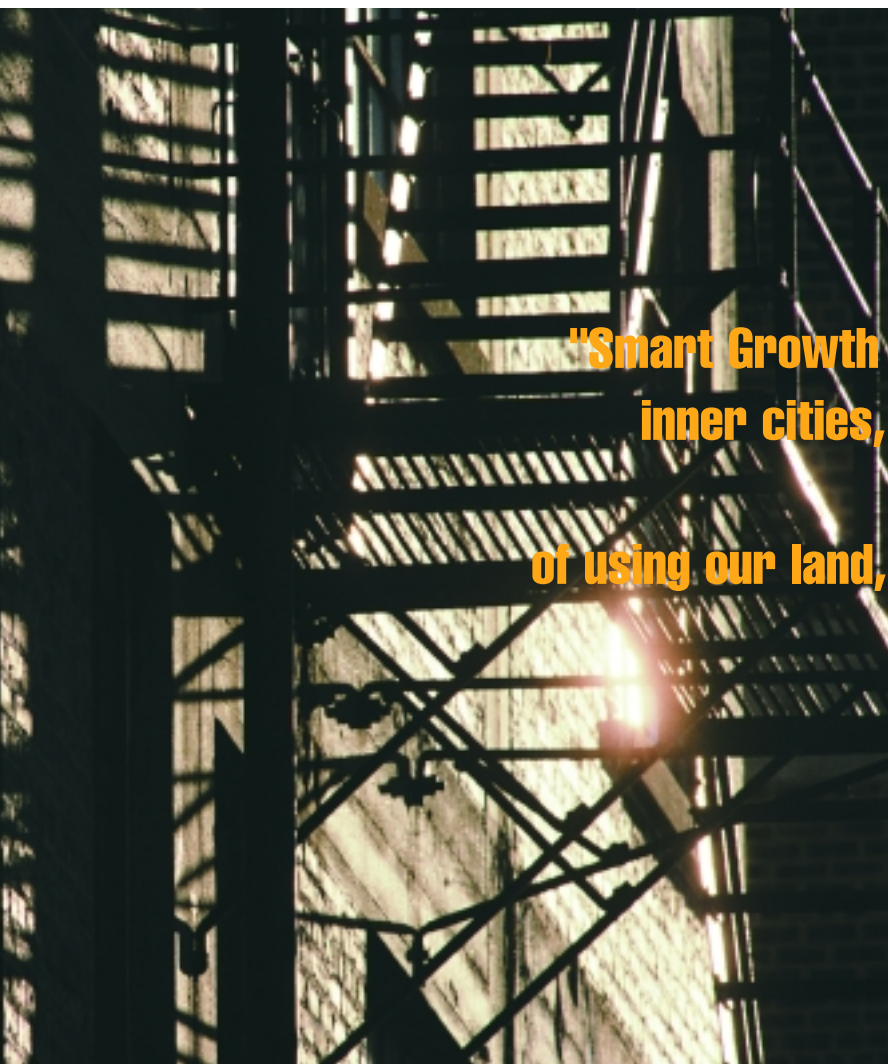




program, Charlotte, North Carolina's abandoned industrial district will soon be home to a vibrant, new, retail community, *Camden Square*. This project, which will have shops, restaurants, and design-related businesses, is integral to the revitalization of Charlotte's 100 year-old industrial district.

The Southeast is home to one of the 16 Brownfields "Showcase Communities" nationwide, the *Eastward Ho!* project in Southeast Florida. Showcase communities are

intended to promote environmental protection, economic redevelopment and community revitalization through assessment, cleanup, and reuse of Brownfields. They also demonstrate the positive results of public and private collaboration, by linking federal, state, local, and non-governmental efforts. The *Eastward Ho!* project is revitalizing Southeast Florida's historic urban core and alleviating development pressures on the imperiled Everglades.



**"Smart Growth is about working together to rebuild our inner cities, where land has already been developed and infrastructure already exists instead of using our land, a limited natural gift, as a disposable product, to be used once and thrown away."**

*Hugh L. McColl, Jr.  
Chairman and CEO, BankAmerica Corp.*

## Chattanooga's Renaissance

Chattanooga had long had the reputation of an industrial powerhouse. Its central location along the Tennessee River at the crossroads of the Georgia, Alabama and Tennessee state lines was an advantage quickly put to use by railroads and other heavy industries. By the 1880s, Chattanooga was a leading manufacturing center in the nation.

But the same geography that brought such success to the city exacted a price. Seated in a bowl where the Appalachian Mountains and weather patterns easily trap man-made pollutants, Chattanooga was cited in 1969 as having the worst particulate air pollution of any city in the nation. Although air pollution and pollution controls had been a part of city life in Chattanooga since the 1920s, the 1969 citation spurred a community movement that brought world wide acclaim, and changed Chattanooga forever.

First, city leaders passed an *Air Pollution Control Ordinance* in 1969 that became the model for the federal *Clean Air Act* of 1970. By 1972, every major source of air pollution in Chattanooga was in compliance with the new

standards. By the late 1980s, it was one of the few cities in the nation meeting standards for both ozone and particulates.

Chattanooga's collaborative success yielded improved air quality and a myriad of other benefits. "Visioning" processes, task forces, and commitment to see decisions through resulted in the City's biggest economic Renaissance in decades. Citizens took pride in their city, their natural resources, their history, and capitalized on them.

Today Chattanooga boasts a multi-recreational riverwalk and world-famous aquarium — attractions that balance environmental and economic needs, and which have spurred investment in a now-booming tourist industry. There are also hundreds of new businesses in the once-decrepit downtown area. Citizens balanced economics, ecology, and community in every effort. Issues like pollution, land use, business investments, and transportation became interrelated causes that every sector of society took a stake in, instead of simply delegating them to their respective experts.



**Getting There Smarter** Transportation control measures are becoming increasingly popular as a means of reducing automobile pollution and encouraging changes in the ways people travel. Communities across our region and country are rediscovering the virtues of mass transit, ride sharing, telecommuting, work schedule

changes, parking management, and roadway tolls. Most car emissions are produced during the first 15 minutes that a car is running, so strategies that eliminate or reduce short trips deliver the most bang for the buck. And auto emissions can be greatly reduced when several strategies are combined.





# Mountains



**T**he Southern Appalachian Mountain chain is one of the most significant features of our Southeastern landscape, covering more than 37 million acres from northern Alabama to Virginia. The eastern portion is dominated by the rugged and diverse Blue Ridge Mountains, which rise abruptly from the Piedmont Province and reach their highest point at 6,684-foot Mount Mitchell in North Carolina. Oak and hickory forests occur at the lower elevations; spruce and fir forests occupy the mountain tops. Variations in elevation and rock and soil types, and associated variations in climactic conditions account for the area's rich biological diversity.

West of the Blue Ridge Province is the Ridge and Valley Province, also known as The Great Valley, which is home to most of the Southern Appalachians' human population. This terrain is rolling to hilly, with southwest running ridges. Predominant land uses are cropland, pastures, and forests. To the west of the Great Valley are the mountains and ridges of the Cumberland Plateau, where coal mining has been an economic mainstay for decades.

**Oak and hickory forests occur  
at the lower elevations;  
spruce and fir forests  
occupy the mountain tops.**



Many of the issues affecting the rest of the Southeast have special significance in the mountains. These include air pollution, poor water quality, forest pests, and habitat losses. The same pressures of human development affecting environmental quality around metropolitan areas are increasingly being felt in rural areas, as more people live closer to forests and mountains.

## That BAD Mountain Air Visibility

Air pollution is not confined to cities; it can be transported hundreds of miles from its source, impacting broad regions of rural resources. Visibility in the mountains began to deteriorate in the 1940s, with the poorest visibility in the summer, when tourists flocked to the mountains. Impaired visibility, or “haze,” is caused when light encounters tiny pollution particles and some gases in the air.

Environmental analyses have indicated that sulfates and organic compounds are the major contributors to haze; nitrate and soil and dust particles contribute to a lesser extent. Sulfur dioxide emitted during fossil fuel combustion is transformed into sulfate particles, which are attracted to water vapor in the atmosphere. In combination with water, sulfate particles, and to a lesser extent organic particles, act to scatter light and decrease visibility. Nationally, coal-fired

electric plants are the major source of sulfur dioxide. The most important sources of organic compounds and nitrate are coal-fired power plants and motor vehicles.

## Acid Deposition

Watershed acidification occurs when nitrate and sulfate particles from the atmosphere are deposited in streams and soils. The particles remove essential nutrients for tree growth, increase the availability of toxic metals and lower the pH of the water. In the Southern Appalachians, the most sensitive waterways are the *headwaters* and other upland streams, where the blood chemistry and gill function of sensitive fish species are altered. The most sensitive forest types are the high-elevation, spruce fir communities with naturally acidic soils, where the addition of more acid from the atmosphere can severely disrupt the forest’s nutrient dynamics.

## Ozone Damage

Ozone, a chemical compound of three oxygen atoms, is a powerful oxidant that is highly damaging or fatal to plant tissues. Symptoms of ozone injury in leaves of sensitive species, such as black cherry, tulip poplar, and American sycamore, have been observed throughout the Southern Appalachians. The primary source of elevated ozone levels in the Appalachians is motor vehicle emissions.





**Mining Effects** The vast reserves of a large variety of minerals and metals always have been part of our Southeastern heritage and economy. In addition to providing jobs, mining of these important natural resources helps meet the nation's energy needs, and supplies raw materials that are essential to consumer goods, industry, and construction. Mining revenues aren't a significant portion of our gross state products and mines occupy very little land area, but several Southeastern states are leading producers of many important minerals.

### Acid Drainage

Past mining operations have caused serious environmental damage in the mountains, in the form of acid drainage from abandoned coal mines. Acid drainage has contaminated mountain streams and harmed or destroyed the plant and animal life in them. Some former mining sites were subsequently used for hazardous materials storage or waste disposal, which has exacerbated the environmental damage. EPA has identified acid drainage from abandoned mines as the primary environmental quality problem in Appalachia, and cleaning it up is very difficult and expensive.

Since 1977, federal law has prevented mining from creating acid drainage problems, and has provided for clean-up of old, abandoned sites. Fees are collected from active, surface coal mining operations and put into a federal

.....  
**Nine of every 10 tons of coal used in the United States are for electricity generation.**

*Abandoned Mine Land* program fund. States are provided money from this fund for cleaning up their abandoned sites. EPA's *Superfund* program works with states to evaluate contaminated sites and identify the highest priorities for cleanups.

## Mountain Top Mining

The practice of removing minerals from the topmost part of mountains has been used in the Southern Appalachians for about 20 years now. Operators flatten the mountain tops during mining to make them topographically suitable for subsequent land uses after the mining is completed. People who favor the practice argue that it's extremely beneficial



## Kentucky Coal Mining Clean-up.

The State of Kentucky has 36 projects underway to reclaim abandoned mining sites in 21 counties, at a cost of over \$13 million. Through these projects, the State will remove the threats of landslides, disposal heaps, acid mine drainage, and abandoned pits. Kentucky also generates money for reclamation through its *Bond Forfeiture* program, which requires mining companies to post a bond for their sites at the start of mining. Later, the bonds are cashed in if the companies vacate their sites without reclaiming them. The State's water supply replacement program installs public waterline extensions in areas where the drinking water supply has been contaminated by past mining activities. Between three and four million dollars are budgeted each year for waterline projects.



because land leveling in mountainous terrain is expensive and difficult. Once the land is leveled, it becomes valuable for commercial timber; farming; recreation; industrial, commercial or residential development; schools; correctional facilities; and many other uses.

Opponents say the practice destroys the mountains' aesthetic character and environment, fills in streambeds, and undermines the area's heritage by fostering unrestricted development. Though the practice is still allowed at this point, public debate over it may rage on for many years to come.

### Mining Aftermath Today

Now, mandatory mining permits ensure that today's mines don't become tomorrow's *Superfund* sites. After mining at a site has been completed, companies are required to restore the land to its original contour (except for mountain tops) and return it to productive use. Also, resources that were originally present, such as timber, wildlife, and fish, must be replenished. Mine operators are also required to contain all of the acid drainage leaving their sites, and control soil erosion.

Only about 35 percent of the high priority coal mining sites nationwide have been reclaimed. The great majority of the sites that haven't been cleaned up yet (about 90 percent) are located in only eight states, including Kentucky in the Southeast.

Post-mining land use changes can have long term, economic, environmental, and social benefits for areas that traditionally relied on mining. In fact, changes in land use frequently go hand in hand with an area's economic revival.

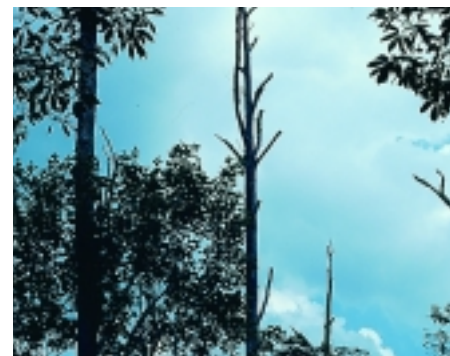
**Great Smoky Mountains** Authorized by Congress in 1926, the Great Smoky Mountains National Park was established in 1934 and was one of the first national parks created from private lands. It is the gem of the Southern Appalachians and has been called "the people's park,"



.....

**Nationally, the coal mining industry has reclaimed more than two million acres of mined land over the past 20 years — an area larger than the State of Delaware.**

Cherokee Indians  
called this place  
Shaconage, “the place  
of blue smoke.”



because of the outpouring of donations from citizens to purchase and protect the park. The Park comprises more than a half million acres and serves as refuge for one of the richest and most diverse collections of plants and animals in the temperate world. No place this size in a temperate climate can

match the Park’s variety of plant and animal species: more tree species than in northern Europe; 1,500 flowering plants; dozens of native fish; and more than 200 species of birds and 60 of mammals. But while we know the Park possesses a vast and varied assemblage of life forms, there is still much we don’t know. For instance, by some estimates the Park possesses more than 100,000 species, excluding bacteria — yet, we have identified only a small percentage of them.

## All Taxa Biodiversity Inventory

The Park Service’s *All Taxa Biodiversity Inventory* will help us learn more about all the Great Smoky Mountains National Park’s varied species. Discover Life in America, Inc. will sample the Park, discovering and documenting nearly all of its species. A scientific survey of this scope and scale has never been undertaken anywhere in the world, and it will serve as a model for future projects in other national parks and protected areas. It’s founded on the notion that knowledge is essential for effective preservation.

## Threats to the Park

A number of existing and impending threats to the Park’s species diversity are cause for concern, vigilance, and action. Forests are threatened by non-native insects and diseases, such as the balsam woolly adelgid, dogwood anthracnose, Chinese chestnut blight, Dutch elm disease, beech bark disease, hemlock woolly adelgid, and the gypsy moth. More conspicuous alien species are also damaging natural systems. The European wild hog, for example, damages fragile natural communities by rooting for grubs, salamanders, and roots, while



## Restoring Biodiversity

In 1985, the Great Smoky Mountains National Park began reintroducing species which had been lost from the area. Most of their attempts have been successful, so now visitors may see river otters teaching their young to catch fish in a mountain stream, or see a peregrine falcon screaming past rocky cliffs at 180 miles per hour! Several small fishes, including the smoky madtom, yellowfin madtom, and dusky darter, have been successfully reintroduced to Abrams Creek. Non-native species of trout are also being removed from the Park's lower elevation streams to prepare for the re-introduction of Southern Appalachian brook trout. Brook trout are currently found only in the highest elevation streams of the Park, where they are affected by acid rain. And soon the magnificent elk will be experimentally reintroduced into the Park.



competing with native species for food. The balsam wooly adelgid, an insect pest, has killed most of the mature Fraser firs in the Smokies over the past 30 years, and the gypsy moth has defoliated much of the eastern hardwood forest.

The Smokies also receive some of the highest deposition levels of nitrates and sulfates in eastern North America; ground level ozone has harmed dozens of plant species and may harm animal life as well. In addition, urban develop-

ment at the Park's periphery has accelerated at an alarming rate, fragmenting and disrupting many biological communities. These and other threats causing serious impacts on the Park's ecosystems natural systems can often be lessened or prevented by park managers using a variety of tools. A comprehensive species inventory will help park managers make informed decisions when prioritizing actions to protect the Park's biodiversity.



# Agriculture





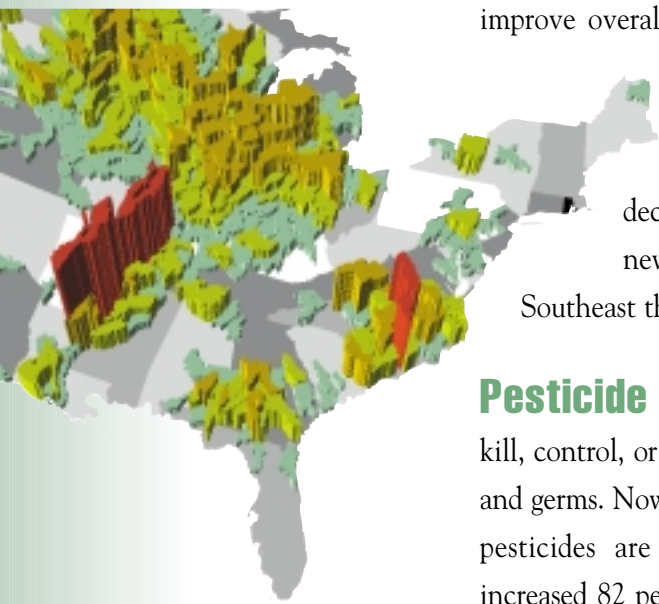
**A**griculture has always been important to our region. Florida is known for its citrus, as well as for strawberries, tomatoes, lettuce, and celery. Georgia was the first state to grow cotton and run a successful cotton mill. Peaches are sweet in South Carolina. Mississippi is swimming in catfish — and tobacco is still important in Kentucky, Virginia, North Carolina, and Tennessee (although it's being rapidly replaced by other agricultural commodities).

Agriculture contributes beauty to our landscapes, provides livelihoods for people in rural communities, feeds our growing cities, and supplies the nation with many important products. Unfortunately, agriculture has also been identified as a primary cause of surface water pollution in our region and throughout the nation. Eroded soil particles from croplands, often with nutrients (nitrogen and phosphorus compounds) and other chemicals attached, enter nearby rivers and streams, and impair their water quality.



**Tobacco is still important in  
Kentucky, Virginia, North Carolina,  
and Tennessee.**

## Pesticide Application Rates\*



\*Represents a relative ranking of watersheds based on pounds of pesticides applied per year.

Over the past two decades, the United States Department of Agriculture (USDA) and American farmers have made significant strides in reducing cropland erosion through soil-conserving practices such as *crop residue management*, *contour tillage*, *stripcropping*, and *land retirement*. In addition to protecting waterways, these newer practices can improve overall soil condition and productivity and help reduce the amount of greenhouse gas released into the atmosphere. However, although cropland erosion is on the decline nationally, adoption of some of the newer practices has generally been slower in the Southeast than elsewhere in the country.

**Pesticide Use** Pesticides are chemicals designed to kill, control, or repel insects, plant diseases, weeds, rodents, and germs. Now a standard part of most farming operations, pesticides are one reason why farm productivity has increased 82 percent in the past thirty years. They are also used to ward off unwanted organisms in homes, schools, parks, hospitals, and office buildings. Seventy-four percent of American households (or 70 million) used some type of pesticide in 1994, at a cost of \$1.9 billion.

Within the past three decades, pesticide use in agriculture, homes, and industries has increased by 50 percent. Total use in the U.S. (including wood preservatives and disinfectants) is about 2.2 billion pounds of active ingredients annually, or



eight pounds for every man, woman, and child in the country.

Misuse and improper management of pesticides can pose serious threats to public health, particularly to infants and children. Children's exposure to pesticides is greater than adults' because of their dietary and play habits. Being physiologically immature also makes them more susceptible to the toxic effects.

Case reports and epidemiological studies show a link between pesticide exposure and the development of certain cancers in children, including leukemia, sarcomas, and brain tumors. In addition, most major classes of pesticides adversely affect the developing nervous systems of experimental animals, impairing both mental and motor development.

Parental overexposure to pesticides, due to misuse or improper storage, has been associated with the development



of certain cancers and birth defects in offspring. And some studies suggest that exposure to pesticides may compromise the immune systems of infants and children and increase their risk of infection and disease.

Although information implicating the hazards of pesticides has been accumulating under the *Federal Insecticide, Fungicide, and Rodenticide Act*, government action to adequately protect the public, particularly children, has been insufficient. Fortunately, more and more concerned citizens throughout the nation are becoming involved, and community leaders are showing people how to reduce the need for pesticides and protect the health and well-being of their communities.

**Animal Waste** Poor management of waste from animal feeding operations is one of the biggest causes of surface water pollution in our region and nationally. Animal waste includes livestock and poultry manure, bedding and litter, feedlot runoff, silage juices from trench silos, and wasted feed. Waste from unprotected animal holding areas and manure storage areas washes into streams and estuaries, where it causes excessive algae growth, fish kills, unpleasant taste and odors, and generally adverse conditions for aquatic

**Poor management of  
waste from animal feeding operations  
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life. Likewise, when it seeps into the ground, the ground water quality can be jeopardized, and because animal waste can carry waterborne pathogens, human health can be threatened if a drinking water source is contaminated. Individual site conditions, such as steep or unprotected slopes, eroded soils, lack of vegetative cover, heavy rains and proximity to streams, play an important role in the potential for environmental damage.



Compounding the threat from animal waste is the fact that the past couple of decades have seen an explosive growth of high-density operations, often called “Megafarms” or “factory farms,” which house large numbers of animals and produce large amounts of animal waste. For example, the number of hogs nationally from farms with 200 or fewer

Some examples of how animal feeding operations are better managing waste:

- ◆ Minimizing runoff and erosion on land where waste is applied
- ◆ Not allowing collection lagoons to overflow
- ◆ Protecting existing wetlands and adding vegetated filter strips along streams to trap sediment and other pollutants
- ◆ Diverting barnyard runoff away from streams and ponds
- ◆ Keeping livestock away from stream banks and wetlands

head per year fell 44 percent from 1982 to 1992, while the number from farms with 5,000 or more head per year increased 257 percent.

When properly managed, animal waste can be a valuable agricultural resource. It’s an economical source of nitrogen, phosphorus, potassium, and other plant nutrients, and it can reduce the need for commercial fertilizers, which tend to degrade soils over time. Animal waste is also useful for adding organic matter to the soil, which improves the soil’s water holding capacity.



## Managed Grazing to Increase Sustainability

*Intensive grazing*, when properly managed, removes animals from riparian areas, reduces weeds, and provides habitat for local wildlife. Though endorsed by many agriculture authorities, its acceptance has been slow in Kentucky, partly because of ranchers' inexperience with required management techniques. However, the Madison County Beef Cattle Association hopes to change all that by initially educating 30 cattle producers and creating a neighbor-to-neighbor outreach system of host farmers who can share their experiences with others in their community. The project, which is being supported by a small grant from the *Sustainable Agriculture Research and Education* program, is striving for broad participation of cattle producers in Madison County, as well as surrounding counties. Progress thus far has included development of a one-day grazing school and



field day that was attended by about seventy cattle producers, and which was so successful, it was the model for a program funded by the Kentucky Department of Agriculture and Kentucky Forage and Grasslands Council.

### Loss of Prime or Unique Farmland (1982-1992)

	Average Acres Converted Per Day to Urban Use	Percent of All Developed Land that was Prime/Unique
Alabama	(29)	33%
Florida	(45)	14%
Georgia	(50)	24%
Kentucky	(35)	35%
Mississippi	(18)	45%
N. Carolina	(81)	31%
S. Carolina	(28)	25%
Tennessee	(44)	36%
Virginia	(37)	30%

As awareness of the problem of animal waste grows, more and more animal feeding operations are putting protective practices into place, referred to as *best management practices* or *BMPs*, to manage their animal waste and reduce threats to waterways. BMPs typically involve the use of facilities, structures, management strategies, and/or vegetative cover.

**Farm Losses** Throughout our history, changes in use and management of private lands have occurred in response to economic, social, or other forces. In the Southeast, millions of acres that were once productive cropland are now covered by forests, and vast areas of the lower Mississippi Basin, which were originally bottomland hard-

wood forests, are now farmed. Also, millions of acres of Southeastern crop land have been converted to residential, commercial, or industrial uses.

While the total acreage of farmland in the U.S. has remained roughly the same since the 1920s, the number of farms has decreased dramatically. Large and small farms have increased in number nationally, but farms in the mid-sized category have declined. The significance of this trend is that the pattern of increasing numbers of small farms, coupled with the rapid growth of urban areas, intensifies the likelihood of “edge effects,” or conflicts arising from the proximity of the two very different land uses.

Incompatibility between new urban areas and agricultural practices and lifestyles can bring unwelcome surprises, both for the homeowners moving into the traditionally rural area, and the remaining, nearby farms. Farm odors, dust, and

Tennessee is one of the top 10 states nationwide in which farmland has been converted to urban use.

Four percent of the state’s total farmland, 436,000 acres, was developed between 1982 and 1992. Of that amount, more than one third was prime or unique farmland.

— *(American Farmland Trust)*

**An increasing number of small farms and the rapid growth of urban areas intensify the likelihood of “edge effects.”**





off-hour operational noises — for example tractors operating at night or in the early morning — as well as other environmental by-products of agricultural operations, often elicit complaints from neighboring non-farmers. Similarly, the arrival of non-farm residences can have some unwelcome effects on farms: rising taxes, severe crop damage from toxic urban runoff, and damage to crops, fences, equipment, and other farm property from increased human trespass onto farm property. Zoning regulations at the county or local government level are often necessary to prevent conflicts between farming operations and non-farm residences.

Why should we care about farm losses? The reasons are myriad, but the most basic is the need to ensure adequate food production for the future. Prime farmland, in particular, is a unique and irreplaceable resource which, once lost, is gone forever.



Jack Rose, photographer

## DELTA F.A.R.M. Program

A group in Mississippi calling itself Delta Farmers Advocating Resource Management, or Delta F.A.R.M., is addressing environmental problems in the Mississippi Delta in a way that both allows farmers to “do the right thing,” and improves their bottom line. Delta F.A.R.M. promotes a variety of “best management” and conservation practices aimed at protecting the environment and supporting wildlife. Some of the practices being employed by program participants include: flooding fields after harvest to create habitat for waterfowl; surrounding fields with duck boxes and planting small wildlife food plots; and planting vegetated strips along rivers, streams and wetlands to filter runoff and promote degradation of pesticides. Participants are also buying pesticides in bulk containers, which have a number of safety advantages over smaller ones and eliminate the need for disposal of numerous, empty chemical containers. During the first six months of its existence, Delta F.A.R.M. enrolled more than 163,199 acres of Delta farmland in the program.

.....  
 “... even if we never set  
 foot on a farm or ranch.  
 Our connection to the  
 land is there every time  
 we buy a loaf of bread, or  
 turn on the tap for a cool  
 drink of water, or admire  
 a flock of geese heading  
 South in the full.”

— (from *A Geography of Hope*, USDA NRCS)



# Rivers



**T**he Tennessee, the Suwannee, the Mighty Mississippi . . . our rivers are part of the very fabric of our Southeastern identity. Since the earliest times, they've been a source of food, recreation, transportation, and livelihoods. The Mississippi, for example, may be the most renowned of our nation's great rivers. It's 2,340 miles long, the longest river in North America, and its delta region is one of the richest farm belts in the country. Or consider the New River which, despite its name, is the oldest river in North America — an estimated 320 million years old.

**Biological Importance** Fresh water covers less than one percent of the earth's surface and comprises less than one hundredth of a percent of the planet's total water. Nevertheless, freshwater rivers and lakes are home to approximately 12 percent of all animals and about 41 percent of the known fish species.

The rivers of the Southeast, according to the World Wildlife Fund, are among the most diverse temperate freshwater ecosystems in the world, but they're being rapidly altered by changes in water quality and quantity, habitat degradation, and exotic species.

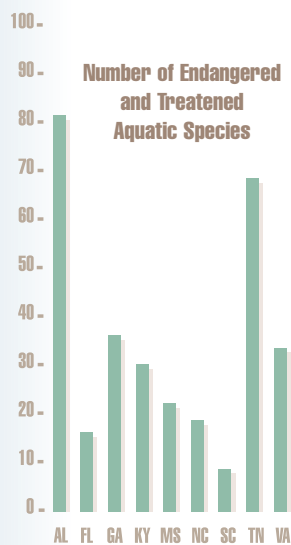
The Clinch River in Tennessee supports the largest number of globally imperiled, freshwater species in the

country. Together with the Powell River, the Clinch boasts a collection of freshwater mussels unmatched anywhere. The Altamaha River watershed of south Georgia has 130 species of rare and endangered plants and animals, including seven pearly mussel species that aren't found anywhere else.



## Over 90 percent of all documented species extinctions have been of aquatic species in the Southeast.

### Imperiled Aquatic Species



Freshwater mussels are one of the most diverse, yet endangered groups of animals in the Southeast, which is home to over two-thirds of the species of freshwater mussels known in the world! Many of these species are on the decline because of poor water quality, loss of habitat, and loss of host fishes for the specialized parasitic larval stage. Most endangered species in the Southeast have declined because of dwindling and fragmented habitats. However, 70 percent of the habitat needed for recovery occurs on private land, highlighting the need for citizen involvement in protecting and recovering these species.

**Watershed Concept** Protecting stream biodiversity isn't easy. A stream corridor or valley is a complex ecosystem made up of the land, plants, animals, and a network of smaller streams in the landscape. Human activities



directly upslope or even many miles upstream may affect a river's ability to renew itself and support aquatic life. Scientists and others concerned with river health know that protecting a river's watershed, or natural drainage basin, is the key to protecting biological diversity.



A *watershed* is the land area that drains to a particular waterbody, such as a lake, river, stream, or estuary. It can range in area from the size of a backyard to the expanse of the continent that empties into the Gulf of Mexico.

**Sources of River Pollution** Just as population and production around the Southeast have steadily risen, so have the demands on our waterways. EPA's 1998 *National Water Quality Inventory* found that 65 percent of the stream segments inventoried were fully capable of supporting the "beneficial uses" (for example, drinking water supply, fish and wildlife habitat, and swimming) they provided in the past. Water quality in the remaining 35 percent of streams inventoried was degraded to an extent that interfered with one or more of the uses.

We've known for over a decade that most of the pollution in our rivers, lakes, and estuaries isn't caused by regulated industries or other "point" sources. Instead, it comes

## Coastal America Removes Quaker Neck Dam

Removal of the Quaker Neck Dam from the Neuse River, near Goldsboro, N.C., has been hailed as the first dam removal in the United States undertaken purely for environmental reasons. Bringing about the removal of the 50-year-old dam took years of work by numerous federal, state, and local partners, environmental groups, and the Carolina Power and Light Company. Key federal partners in this *Coastal America* project were the U.S. EPA, U.S. Army Corps of Engineers, U.S. Fish and

Wildlife Service, and National Marine Fisheries Service. The project restored unimpeded access to 75 miles of the Neuse's main stem and 925 miles of tributary streams for several anadromous fish species. Already, spawning by striped bass and American shad has been observed 78 miles above the former dam site for the first time in 46 years, and their numbers have increased in each of the three spawning seasons since the dam was removed.

## River Miles Too Polluted for Support of Desirable Fish, Shellfish, and Other Aquatic Life

	% of State's River Miles Assessed	% of Assessed Miles That Are Impaired
Alabama	4%	*5%
Florida	9%	7%
Georgia	9%	16%
Kentucky	17%	13%
Mississippi	46%	1%
N. Carolina	89%	*14%
S. Carolina	65%	9%
Tennessee	88%	6%
Virginia	41%	2%

\*States of AL and NC did not specifically assess "aquatic life support"; percentages shown are for river miles impaired for one or more state-designated use.

from numerous, indistinct and untraceable sources that each deposit pollutants on the landscape. Those contaminants are collectively delivered to waterways by rainwater and snowmelt “running off” the land. We refer to this multitude of pollution contributors as non-point sources.

Regionally and nationally, agriculture is the single, most important cause of water quality degradation in our rivers. Agricultural runoff often contains fertilizers, pesticides, top-



soil, and silt that upset or destroy the physical and biological integrity of rivers. Sediments and excess nutrients (nitrogen and phosphorous compounds) are the two most significant pollutants.

While not reaching the causal proportions of agriculture, municipal sewers and urban runoff are also significant contributors to surface water pollution. Urban runoff from hard sur-

faces such as concrete and asphalt typically contains motor oil, antifreeze, gasoline, and other petroleum residues. Other typical pollutants in urban runoff are household and commercial cleaning products, and fertilizers and pesticides from residential lawns and commercial landscaping. In fact, the U.S. Geological Survey’s (USGS) *National Water Quality Assessment* (NAWQA) program found that commercial insecticides occur more often, and usually at higher concentrations, in urban streams than in agricultural streams. This is despite the fact that urban areas cover less than 5 percent of the country compared to more than 50 percent for agricultural lands. Insecticides, which are generally more harmful to aquatic life than herbicides, were found in virtually every urban stream sampled by NAWQA, frequently at levels exceeding federal water quality guidelines.

Today, interest in controlling polluted runoff and restoring the health of urban and rural stream corridors is expanding nationally and internationally.

**Fish Consumption Advisories** Fish living in polluted waters can accumulate chemicals in their tissues to concentrations that are much greater than the concentration of the chemical in the water. State environmental and health agencies issue fish consumption advisories to warn the public of non commercial fishing areas where pollutant concentrations in edible fish have reached levels that are potentially harmful to humans. The advisories may indicate





**Insecticides, which are generally more harmful to aquatic life than herbicides, were found in virtually every urban stream sampled by NAWQA, frequently at levels exceeding federal water quality guidelines.**

Fish Consumption  
Advisories

	Number of Advisories in Effect in 1998	Change from 1997
Alabama	13	0
Florida	98	+1
Georgia	96	+59
Kentucky	6	0
Mississippi	13	+1
N. Carolina	17	0
S. Carolina	26	0
Tennessee	17	0
Virginia	7	-1

*\*Note: The number of advisories issued per state is partly dependent upon each state's resources for issuing advisories and vigilance in monitoring fish contamination.*

that a particular type of fish shouldn't be eaten at all, or should be eaten only in limited quantities.

The State of Florida, for example, has issued fish advisories throughout the Everglades, one of our most distinctive aquatic ecosystems, warning people to limit their consumption of fish from those waters. Unfortunately, once an area becomes contaminated to an extent that warrants an advisory, it often remains contaminated for a very long time.

**Water Supply and Use** Water quantity and quality are intricately linked and interdependent factors, which must be delicately balanced for effective resource management.

The U.S. has 3.6 million miles of rivers. Roughly 14 percent of them are in the Southeast, covering about 4 percent of our region's total land area. Water from Southeastern rivers and streams is put to a variety of uses for the benefit of society. In 1990, Southeastern states withdrew almost 60 billion gallons of fresh water per day from area surface waters. Thermoelectric power generation was the largest use (more than half), though only a small fraction of that water was actually used up. Most of it was sent back into the environment and became available for other uses. About 5 percent of regional withdrawals were used for irrigation, and domestic use accounted for about 6 percent.

The country's recent economic prosperity, regional population growth, and two years of near-record drought con-

Water Wars

Water shortages are no longer an issue only in the arid western U.S. Here in the Southeast water allocation has become a critical issue for at least two river systems whose future flows will impact enormously on the life, health, and economic well being of three of our states: Alabama, Florida, and Georgia. Water quantity concerns center on the Apalachicola-Chattahoochee-Flint (ACF) River Basin, which touches all three states, and the Alabama, Coosa, and Tallapoosa (ACT) River Basin in Alabama and Georgia.

In the ACT River Basin, overconsumption of water and a failure up until now to adequately address the sources of water pollution are the most immediate concerns. Metropolitan Atlanta is consuming land at an unprecedented rate and looking to sources farther and farther away to try to meet its water supply needs. About a decade ago, Congress and the Courts intervened in the battle over water in the ACT Basin by bringing the states of Alabama, Georgia, and Florida together to negotiate a water resource allocation plan. Coming to a consensus on how water will be allocated between three growing states is a difficult and highly contentious process, and the original deadline for the plan has already been exceeded four times. The extensions allow the three states to keep negotiations alive, and potentially avoid a long, costly, and counterproductive legal battle before the Supreme Court.



ditions have all placed unprecedented stresses on our existing water sources. These stresses are further complicated by increased pressure to leave water in streams and rivers for environmental and recreational needs, as well as by the fact that the 20th century means of increasing water supplies — building more dams — is no longer viable. Today the focus in water management is increasingly on entire river basins and watersheds, sometimes spanning multiple states. And increasingly, threats of shortages are looming. Effective water management and conservation strategies will be more important for meeting our region's water needs than ever before.

The good news is that the public and industrial conservation programs, improved technologies and plant efficien-

cies, and more efficient irrigation systems and techniques all appear to be moving us in right direction. According to the USGS's *Trends in Water Use* report, though the country's population grew by 6 percent from 1990 to 1995, freshwater withdrawals for public water supply only rose about 4 percent, and most other categories of use declined. However, as the region's population continues to increase, placing higher demands on existing supplies for public and domestic use, water prices will escalate, and agricultural users may have increased difficulty competing economically for water. For the first time, water managers in this part of the country will be faced with the daunting task of continually reconciling the needs of rural users with those of growing urban populations.





# Coasts





**T**he Southeast has more miles of coastline than any other region of the country — more than one-quarter of the total conterminous U.S. coastline. Our coastal bays and estuaries are home to some of the most unique and valuable aquatic resources anywhere.

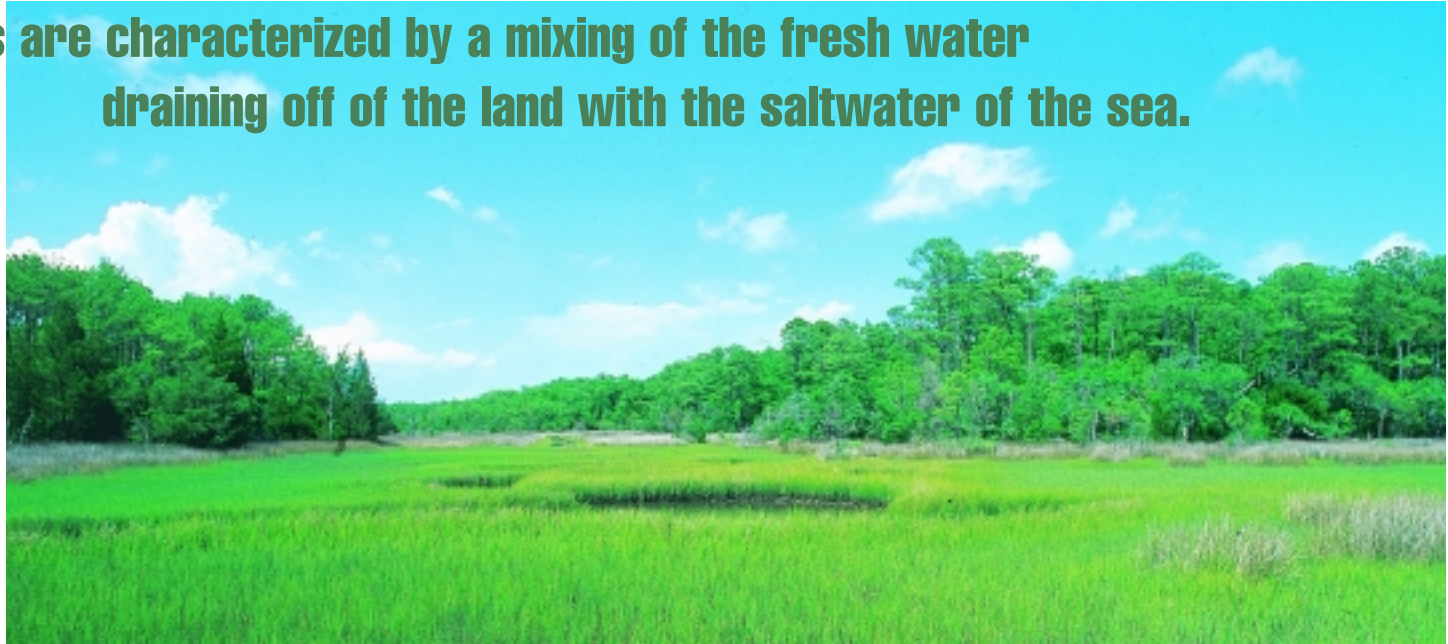
Chesapeake Bay, off the coast of Virginia, is the largest estuary in North America. It covers more than 4,200 square miles, supports 2,500 species of animals and plants, and has historically been the country's most productive estuary. Chesapeake Bay has a 64,000 square mile drainage basin or watershed that includes portions of six states.

The Gulf of Mexico's shrimp fishery is the most valuable in the nation. The Gulf provides more than 75 percent of the nation's commercial fish and shellfish landings, worth \$2 billion annually, and supports an additional \$25 billion in related economic activity (for example, tourism and recreation). Mississippi Gulf coastal wetlands provide essential habitat for numerous fish species, roughly 138 bird species, 31 shellfish species, six reptile species, and 11 mammal species. In addition, the Gulf provides critical habitat for 75 percent of the migratory waterfowl that cross the U.S., and half of the nation's remaining wetlands occur along the Gulf coast.



**An estuary is an area along the shoreline  
where a river enters the sea.**

**Estuaries are characterized by a mixing of the fresh water  
draining off of the land with the saltwater of the sea.**



**Why are Estuaries Significant?** Estuaries are significant to both marine life and people. They are critical spawning grounds and nurseries for fish, shellfish, birds, and other wildlife. Marsh plants and other vegetation in estuaries protect marine life and water quality by filtering sediments and toxic pollutants from runoff, and by acting as barriers to damaging waves and floods.

Estuaries are also valuable for economic, recreational, and aesthetic reasons. People love water sports and visit

estuaries to boat, fish, swim, and enjoy their beauty. For this reason, the economies of coastal areas frequently depend on the natural beauty and bounty of their estuaries. Estuaries often have ports serving shipping, transportation, and industry, and healthy estuaries support profitable, commercial fisheries.

Water, plants, and animals (including humans) are all components of the estuary's ecosystem. When those components are in balance, natural resources flourish. But when



## Pfisteria: Red Tide Harms Fish, Possibly Humans

There's mounting evidence that a toxic algae that has killed "billions" of fish and caused red tides from Delaware to Florida, is causing painful illness and amnesia in humans. Neurologists at Duke University in North Carolina have linked the algae, *Pfisteria piscicida*, to short-term memory loss in rats. Also, over the past few years, several scientists who worked in labs where the algae was grown for research, and divers who swam in North Carolina red tides have experienced new health problems. Symptoms included disorientation, difficulty with simple math problems and sentence structure, ulcers on the legs, and burning eyes.

Researchers believe *Pfisteria* may be the "common denominator" in the health problem cases, but that link has yet to be scientifically established. One theory purports the algae are thriving on sewage, livestock wastes, industrial and farm pollutants, and urban runoff. Another theory blames the outbreaks on warmer ocean temperatures and changing weather patterns.

human activities upset the balance, government authorities end up having to close beaches and shellfish beds, and issue public warnings discouraging fish consumption.

**Pollution Sources** Agriculture has had a significant impact on coastal resources. Runoff from farmland of nitrogen and phosphorus compounds, sediment, and pesticides into rivers and streams eventually ends up in coastal waters. Farmers use millions of tons of nitrogen products per year, much of which finds its way into waterways that drain to the coast. Two-thirds of the continental U.S. drains to the Gulf of Mexico alone. But agriculture isn't the only culprit where nitrogen runoff is concerned. Municipalities and industries release more than a quarter-million tons of nitrogen compounds per year to rivers and streams.

**Growth Comes to the Coast** Roughly half of the world's population currently lives in coastal areas, and the same will be true for the U.S. population by the year 2010. Currently, more than a third of our region's population lives in a coastal area. Coastal counties are growing three times faster than inland areas. People need housing, services, and roads, so new industries and businesses arrive to provide them. Fragile coastal marshes and estuaries are disrupted by development activities, and sickened by the stream of toxic chemicals running off lawns, roads, and other urban surfaces. We're losing the benefits of the natu-

### Shellfish Bed Closures

	Number of Areas Classified as 'Prohibited'		Percent of Total Areas 'Prohibited'
	in 1985	in 1995	in 1995
<b>Mid-Atlantic</b>			
Virginia	119	12	<1
<b>South Atlantic</b>			
N. Carolina	406	394	14
S. Carolina	68	45	6
Georgia	102	101	54
Florida	37	50	30
<b>Gulf of Mexico</b>			
Florida	278	271	20
Alabama	86	88	30
Mississippi	107	56	13

## The Dead Zone

More than 7,000 square miles of the Gulf of Mexico may be totally devoid of life for several months of the year.



This “dead zone” is caused by pesticides and fertilizer washing off agricultural lands in the Mississippi River’s watershed, and traveling downstream to the Gulf. Every year during the spring and summer, the massive amounts of nitrogen in these products trigger an algal bloom in the northern Gulf that strips the water of vital

oxygen. The low-oxygen conditions wipe out most bottom-dwelling organisms, including starfish, worms, and single-celled animals. At the same time, populations of organisms that prefer the low-oxygen conditions increase dramatically, leaving a white, cottony mass on the surface of the water.

The long-term economic, ecological and biological effects of this recurring event on fisheries and other Gulf resources aren’t precisely known at this time, but one thing seems certain: they won’t be beneficial. For example, fishermen who make their living from Gulf resources may be spending more time and more fuel traveling farther out into deeper waters, for the same catch they would otherwise be pulling in from areas closer to shore.

The dead zone is an example of what happens, on a smaller scale, in coastal estuaries around the country. It’s also an example of how an environmental consequence can be manifested far from the point of the activities that caused it. The Gulf of Mexico Program, a cooperative of federal, state, and local agencies and private entities, has been studying the problem of the dead zone for several years. When its causes are finally remedied, the ecological benefits will be manifested, not only in the Gulf, but far up the Mississippi River Valley, in the watersheds that were the original source of the problem.



ral storm-buffering and water filtration functions wetlands perform, as well as the health of the fisheries they support.

**Coastal Weather Events** Seasonal hurricanes are a fact of life along the South Atlantic and Gulf Coasts. In 1999, North Carolina was subjected to repeated assaults by Hurricanes Dennis, Floyd, and Irene. The biggest impact of those storms was the widespread flooding, but experts say future storms may produce even greater floods. One of the most important functions of coastal wetlands is to buffer

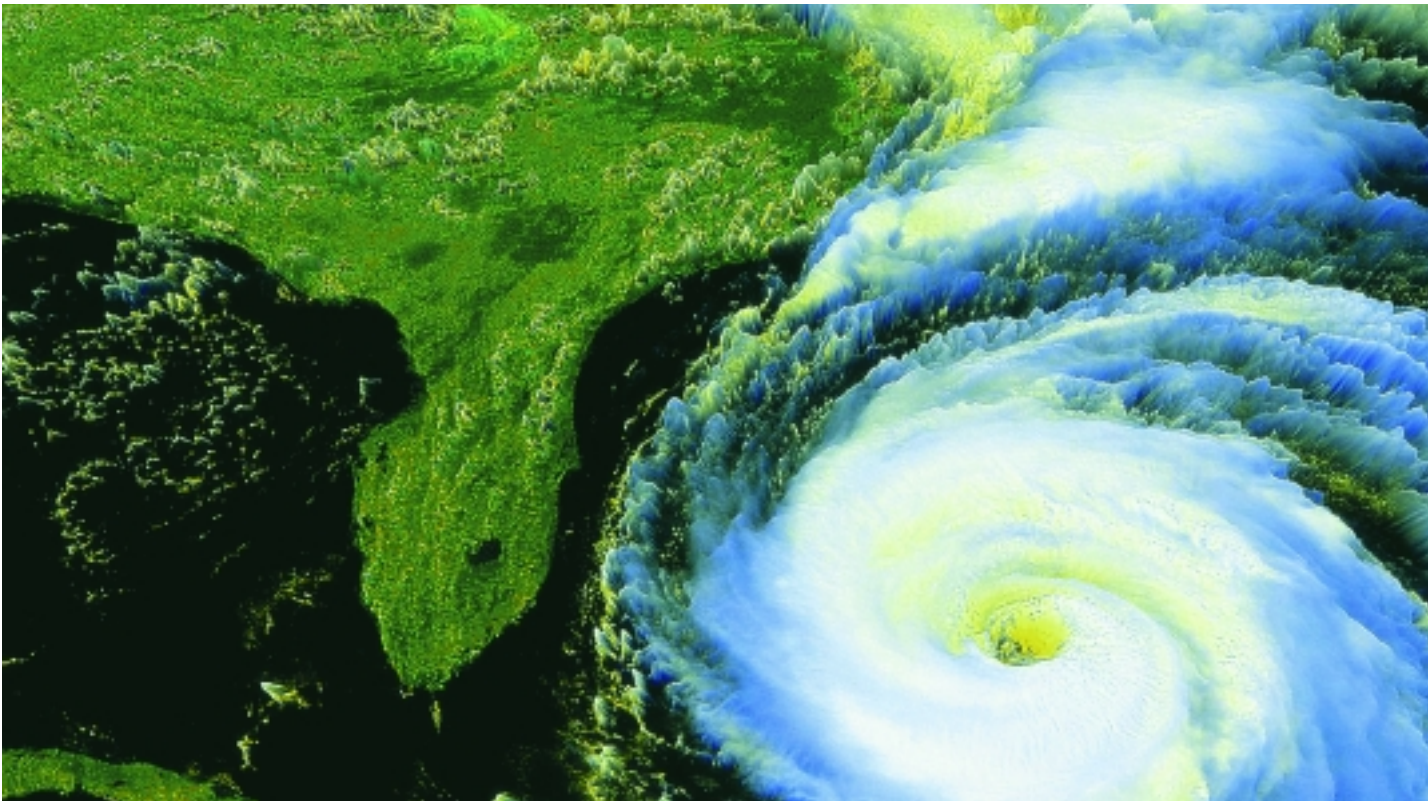
storm surges. Floodplains naturally contain flood flows. However, continued rapid urbanization of the Raleigh-Durham-Chapel Hill area and other floodplain areas, coupled with recent, wholesale modification of coastal North Carolina wetlands and floodplains make continued vulnerability to storms almost a certainty.

Cases of respiratory, gastrointestinal, and dermatologic illnesses all skyrocketed during the first two weeks following Hurricane Floyd. Emergency room visits for dermatologic illnesses, rashes, and scratches were up 65 percent the first

Percent Resident Population  
Growth for Selected Coastal  
Counties (1982-1997)

<b>ALABAMA</b>	<b>9.1%</b>
Baldwin County, AL	36.1%
<b>MISSISSIPPI</b>	<b>6.4%</b>
Hancock County, MS	32.9%
<b>GEORGIA</b>	<b>24.5%</b>
Camden County, GA	64.3%
<b>FLORIDA</b>	<b>28.5%</b>
Nassau County, FL	35.7%
Brevard County, FL	35.1%
Palm Beach County, FL	36.6%
Collier County, FL	49.0%
Hernando County, FL	55.9%
Dixie County, FL	34.3%
Levy County, FL	32.7%
<b>SOUTH CAROLINA</b>	<b>14.7%</b>
Horry County, SC	35.4%
Beaufort County, SC	33.2%
<b>NORTH CAROLINA</b>	<b>18.9%</b>
Brunswick County, NC	41.3%
Carteret County, NC	26.7%
Currituck county, NC	32.6%
Dare County, NC	47.6%
<b>VIRGINIA</b>	<b>18.4%</b>
King George County, VA	38.1%
York County, VA	36.9%

\*Nationally, resident population growth from 1982-1997 was 13.4%.



**More than 43,000 homes sustained some degree of damage, and the state of North Carolina will spend more than \$100 million, plus federal mitigation funds, to buy out flood-prone properties.**



week, and 79 percent the second week. Animal bites were up a whopping 30 percent from snakes, 169 percent from dogs, and 246 percent from insects. Timely and effective aerial spraying probably prevented increases in mosquito-transmitted diseases when mosquito populations exploded during the periods following the storms.

More than 2,000 community and non-community drinking water systems in eastern North Carolina were impacted by flooding from the three hurricanes, with some remaining inoperable for periods of up to several days.

Total damages from the three storms to crops, farm structures, and livestock were over \$800 million. More than 43,000 homes sustained some degree of damage, and the State will spend more than \$100 million, plus federal mitigation funds, to buy out flood-prone properties.

Determining the full extent of the storms' impacts on eastern North Carolina waterways, particularly the estuaries and sound, is probably years off, but among those impacts will be effects from animal feedlot chemicals and pathogens, including genetically resistant bacteria; other agricultural



## Gaming on the Gulf Coast

The Mississippi Gulf Coast has experienced unprecedented growth and development since dockside gaming was legalized there in 1990. As of March 1998, 23 permits for casino construction had been issued; and by 1999, 12 casinos were in operation. The casinos attract 50,000 visitors per day, and more than 20,000 new residents moved to gaming counties between 1990 and 1995.

Gaming has brought a much-needed economic boom to Mississippi, but its environmental impacts may be even more significant in the long run. While the casino barges themselves have had a relatively minor environmental impact, the impacts of the new development generated by their presence — that is, the new homes, roads, restaurants, gas stations, and golf courses — have hit the region hard.

Existing highway and sewage treatment facilities have proven inadequate, and problems such as stormwater runoff and septic tank leaks are causing serious water quality problems along the Gulf and in the backwaters. According to federal resource agencies, casino construction is having these direct and indirect impacts on Gulf coastal resources:

- ◆ Wetlands and water bottoms are being filled and/or degraded, and rivers, lakes and estuaries are receiving more polluted runoff.
- ◆ Shorelines are being altered and/or eroded, scenic views along the coast are being altered, and public access to the waterfront is being restricted.
- ◆ Water bottoms are being shaded, cutting off phytoplankton, the base of the aquatic food chain, from sunlight.
- ◆ Species compositions of coastal marine biotic communities are being changed.
- ◆ Water chemistry, temperature, and local current circulation patterns are being changed, and toxins are being released from sediments.
- ◆ Oyster reefs and seagrass beds are being altered or destroyed.

Large-scale protection of resources will be critical to maintaining the integrity of coastal ecosystems in the 21st century.

pollutants, such as pesticides and fertilizers; and petroleum products. In addition, more than 130 underground storage tanks released at least some of their contents into waterways, and decaying corpses of dead animals, both domestic and wild, added stresses to the ecosystems.

The irrefutable lesson of the 1999 hurricane season is that inappropriate development and land uses in coastal wetlands and floodplains aren't in anyone's long-term best interest.

**Coastal Restoration** Habitat restoration has been used for environmental reparation for many years now, but in the past, it was primarily an opportunistic venture. Land was

bought and a single habitat type was restored to protect whatever species had gotten the public's attention, and restoration efforts usually had to settle for whatever land was available for purchase. Recently, the concept of restoring whole landscapes in order to recreate the natural balance between habitats and species has come to the fore. It's based on the idea that "habitat mosaics" are the essence of healthy and balanced ecosystems. This approach requires a departure from opportunistic land acquisition and a move toward broad-based collaborations between public and private landowners. It maximizes benefits to wildlife by providing areas that support whole communities of animals – not just one or two endangered species.



**Local governments and communities are coming together to restore resources that not only benefit wildlife but enhance the quality of everyone's life.**



**Coastal Conservation** Between Charleston and Beaufort, South Carolina lies the largest coastal wetland in the Southeast, outside of the Everglades. Called the ACE Basin (for the three blackwater rivers that converge there, the Ashepoo, Combahee and Edisto), it consists of approximately 350,000 acres of diverse habitat.

Designated a world-class ecosystem under The Nature Conservancy's *Last Great Places* program, the basin's unique system of estuaries is the focus of one of the most successful conservation partnerships in the country. Federal, state and local government agencies have joined with private organizations such as Ducks Unlimited and The Nature Conservancy to form the ACE Basin Task Force, which has conserved almost 130,000 of the basin's most environmentally sensitive acres. Of that total acreage, 50,000 acres are publicly accessible conservation lands managed by federal, state, and local resource agencies. In addition to being ecologically valuable, the region is rich in history. Historic and cultural landmarks, such as old plantation homes, forts, cemeteries, and churches, are also being preserved through the project.

What sets the ACE Basin project apart from many similar projects is the role private landowners have played. Voluntary conservation easements have ensured the perpetual protection of almost 80,000 acres of former rice plantations, bottomland hardwood forests, marshes, and rare stands of maritime forest and longleaf pine.

## Saving the Tampa Bay Estuary

The *Tampa Bay National Estuary Program* and its partners are endeavoring to restore some of Florida's most ecologically degraded, coastal habitats. Low-salinity, tidal streams are a main focus because of their critical importance to fish life cycles and waterfowl. The program will also restore mangrove forests, salt barrens, upland forests, and mud flats that are part of coastal ecosystem's habitat mosaic.

It will also acquire 100 acres of tidal streams every five years, through direct land purchases and conservation easements. A hundred acres have already been restored, and several projects currently underway will soon boost that number to 1,000 acres. Other targets include: restoration of 123 acres of Old Tampa Bay coastal habitat, 140 acres in Hillsborough Bay, 575 acres in Middle Tampa Bay, 710 acres of Lower Tampa Bay, 40 acres in Boca Ciega Bay, and 1,000 acres of foraging area for white ibis and other wading birds in the Alafia Banks — and protection of nearly 150 acres of mangrove and salt marshes.

# Forests





**F**rom the mangrove swamps of Florida . . . to the sandy pine forests of the Atlantic and Gulf coastal plains . . . to the interior pine oak forests of the rolling Piedmont . . . to the spruce fir forests of the Southern Appalachians . . .

Forests are a dominant feature on the Southeastern landscape, occupying more than 60 percent of our region. Our Southeastern forests are some of the most productive and ecologically diverse forests in the world. The proportion of our states covered by forests ranges from just over 40 percent in Florida, to over 65 percent in South Carolina and Georgia.



**The proportion of our states covered by forests ranges from just over 40 percent in Florida, to over 65 percent in South Carolina and Georgia.**

The distribution of forest types throughout the Southeast is determined by many environmental factors, including climate, topography, soils, and past land uses.

Forest cover in most of the Southeast was essentially unbroken in pre-Colonial times. Clearing for agriculture took off toward the end of the 18<sup>th</sup> century, and by modern standards, early forest clearing practices were often abominable. Huge areas were slashed and burned, causing permanent damage to the fragile underlying soil, widespread

### Who Owns the Southeast's Forest Land?

- ◆ 10.5 percent owned by the public
- ◆ 19.5 percent owned by the forest industry
- ◆ 70 percent owned by private individuals

**Historically, huge areas were slashed and burned, causing permanent damage to the fragile underlying soil, widespread erosion, and extensive silting of rivers and streams.**





erosion, and extensive silting of rivers and streams. However, as more and more practical uses for timber arose, so evolved a newfound appreciation for the economic value of forests and trees. Trees meant fuel for steamboats and cotton mills, charcoal for pig iron works, and lumber for building construction and export — in essence, they helped fuel the region's burgeoning economy.

During the past century, our forests have made a great recovery. We have more acres of forest now than we did at the turn of the 20th century. Since the 1950s, forest acreage has been relatively stable, with small, local gains and losses occurring when marginal farmlands were allowed to revert back to a forested condition, or urban areas expanded. But today our forests are being increasingly threatened by new factors that may prevent their meeting our current and future needs. Unlike in the West, where most of the forest land is publicly owned, most Southeastern forest land is, and has traditionally been, privately owned.

The number of private forest landowners in the region has increased over the past several decades, while the amount of forest land has remained fairly constant. This trend has resulted in smaller average forest parcel sizes, which greatly complicates the task of achieving sustainable forest management practices at the landscape, state, or regional level.

Our National Forests are managed for multiple uses, including timber, water supplies, wildlife habitat, fisheries,



and recreation. However, the demands on them have increased over the past several decades as our urban populations have expanded. With increased public desire for safe drinking water, increased recreational opportunities, and wildlife habitat protection, we'll likely see increased pressure on private forests to produce the wood products that fuel economic growth.

**Forest Health and Sustainability** Our society depends on the many, important goods and ecological services intact forests provide, including: clean air and water, biological diversity and productivity, fish and wildlife habitat, recreation, and aesthetic enjoyment. There are characteristics of forest ecosystems akin to human “vital signs” that

we can measure and monitor over time to assess our forests' long-term ability to provide these benefits. Chief among them are biological and non-biological “stressors” — for example: forest insects and diseases, invasive plants, air pollution, fire, storms, drought, and increasing urbanization.

**Urbanization: Forest Loss and Fragmentation** Over the past century, the demographic structure of the region has shifted from predominantly rural, agricultural communities to densely populated, urban areas with smaller, diffuse rural populations. This shift has widened the gap between urban and rural residents' perception of forests and the benefits they provide, and has led to increased conflicts over how our forests should be managed.

Population growth usually results in forest land being converted to non-forest uses — particularly urban development. Not only is the quantity of forest acreage reduced, but habitat quality suffers as forests become fragmented into small, isolated patches.

Large tracts of dense forest provide relatively rare and high quality “interior” forest habitat not found in smaller patches. Interior forest habitat is the portion of a forest stand that lies far enough away from the forest edge as to shelter it from predators and climactic and human disturbance.

In general, urban development has been responsible for the most forest fragmentation, followed by agriculture and forest management practices. Over the past couple of



decades, areas along major transportation corridors, such as Interstates 85 and 95, and near expanding urban centers, such as Atlanta, Georgia; Raleigh-Durham and Charlotte, North Carolina; Chattanooga, Tennessee; and Washington, D.C. have experienced some of the highest forest loss and fragmentation. Similarly, areas throughout the Piedmont, portions of the coastal plain in north central Florida, and along the Mississippi River floodplain have experienced tremendous forest loss due to conversion to agriculture.

**Intensive Forest Management** Timber is the most important agricultural commodity in the Southeast. “Intensive forest management” has become synonymous with practices as clear-cutting; extensive use of herbicides and pesticides; replanting to a “monoculture” or single, commercial tree species; and use of genetically improved seedlings, and reliance on short rotation periods



## Longleaf Pine and Bottomland Hardwoods

These forest types are receiving a great deal of attention as a result of both past and current land use practices. Historically, longleaf pine occupied nearly 90 million acres throughout the South; now it occupies less than three million acres, or three percent of its historic distribution. One of the most biologically diverse ecosystems in the region, it supports hundreds of species, including the federally endangered red-cockaded woodpecker. Many longleaf pine stands originally cleared for agriculture and timber harvesting have been replaced by loblolly pine — a fast-growing species favored by commercial timber growers.

The U.S. Forest Service and non-profit organizations such as the Longleaf Alliance are encouraging forest industry and private landowners to replant harvested areas with longleaf pine within its native range.

Bottomland hardwood forests formerly occupied millions of acres of fertile, alluvial, floodplain soils along Southeastern rivers. These “forested wetlands” help prevent soil loss, filter sediment and nutrients in stormwater runoff, reduce flooding, and provide critical wildlife habitat. Two-thirds of the wetland losses in the U.S. have been of forested wetlands — primarily in the South, and primarily for conversion to agriculture.

Numerous efforts are underway throughout the

region to restore native bottomland hardwood habitats. Several federal programs, chiefly the Conservation Reserve Program and the Wetlands Reserve Program administered by the USDA’s Farm Service Agency and Natural Resource Conservation Service, provide financial incentives to private landowners to replant hardwoods in formerly wet areas of farmlands that are of marginal quality. Over 150,000 acres of marginal farmland in the region are currently enrolled in the Wetlands Reserve Program.

.....  
Over two million acres  
of marginal farmland  
have been replanted to  
pine forests – much of  
it to longleaf pine.



## What are Sustainable Forestry practices?

- ◆ Conserving biological diversity
- ◆ Maintaining the productive capacity, health, and vitality of forest ecosystems
- ◆ Conserving soil and water resources
- ◆ Maintaining and enhancing long-term socio-economic benefits that meet the needs of society.



for cutting. Three quarters of the region's timber plantation acreage, where these practices are most prevalent, is in Alabama, Florida, Georgia, and Mississippi. Ninety-four percent of the plantation acreage is privately owned.

The good news is that many federal and industrial timberland owners have begun to use “sustainable forestry” practices on their lands to sustain the full spectrum of values and benefits provided by forests.

**Air Pollution** *Tropospheric ozone*, meaning ozone in the portion of the earth's atmosphere where cloud formation occurs, is the most significant air pollutant impacting forest health in our region. High ozone levels occur near, or downwind from, industrial facilities and urban centers. Ozone enters plant leaves through their normal physiological processes, damaging leaf tissues and subsequently reducing growth and reproductive capabilities. Another significant air pollutant is atmospheric nitrogen, which leads to acidification of high-elevation watersheds.

**Forest Insects and Diseases** Insect and disease damage is causing significant hardwood and softwood timber loss in the Southeast. Forest insects causing some of the worst damage are the Southern pine beetle, gypsy moth, balsam wooly adelgid. Southern pine beetle is one of the most serious insect pests of pine forests in the South. Insect outbreaks occur cyclically throughout the region, and an epidemic is always in progress somewhere within the natural range of this pest.

The gypsy moth came to the U.S. from Europe in 1869. First appearing in Massachusetts, it has steadily expanded its



range north, west, and south. Gypsy moths cause widespread defoliation, resulting in reduced growth and vigor, then mortality. They also reduce aesthetic, recreational, and wildlife values.

The balsam wooly adelgid made its appearance in the southern Appalachians in the 1950s. It feeds on balsam and Fraser fir trees at higher mountain elevations and injects a toxic substance into the tree's cell tissues that interferes

with its ability to process water and nutrients — ultimately, starving the tree. Vast stands of balsam and Fraser fir have been wiped out by this pest.

Major forest diseases in the Southeast are dogwood anthracnose, oak decline, and fusiform rust found on southern pines. Dogwood anthracnose affects flowering dogwoods and is primarily restricted to higher elevations and cool moist sites at lower elevations.



**Dogwood anthracnose affects flowering dogwoods and is primarily restricted to higher elevations and cool moist sites at lower elevations.**

## A New Pest in the Southeast

The Hemlock wooly adelgid is now threatening to spread throughout the range of hemlock trees. Once

hemlocks are infested, they become weakened, gradually lose their foliage, and are unable to regrow foliage or produce cones. Death usually occurs within five years of the initial infestation. There is no known genetic resistance or cost-effective treatment for the adelgid for either of the two hemlock species native to the Southeast. At this point, we can only watch as the pest slowly moves through the entire range of Eastern and Carolina hemlocks.



Oak decline affects both upland and bottomland oak species. Several factors, such as climate, site quality, and tree age can weaken trees and predispose them to diseases which wouldn't ordinarily kill vigorous trees. Typically, there is a gradual, but progressive, "dieback" of the tree's crown, typically resulting in death after several years. Tall, mature trees are the most heavily afflicted.

Fusiform rust is the most important disease affecting pine tree species in the region. Roughly 16.7 million acres of slash and loblolly pine forest have at least 10 percent of the trees





infected. The disease forms cankers on branches and the main stem of pine trees, and generally kills the tree within five years.

**Invasive Plants** Millions of acres of Southeastern forest land are increasingly being occupied by harmful, invasive plants. These are non-native species that have been imported into the U.S. and released either intentionally, as ornamental species, or accidentally, as “hitch hikers” via automobiles, trains, airplanes, or ship bilges. Once released into the environment, they spread rapidly, forming dense

infestations and competing with native vegetation for space, light, and nutrients.

They are hardy competitors and out-compete native forest species for several reasons. They have no natural predators in their new environment, they usually tolerate shady forest conditions, and they reproduce rapidly. The total infested acreage and spreading rates of encroaching exotic plants in the Southeast are unknown, but Kudzu and Japanese honeysuckle alone occupy over seven million acres each, and they are still spreading.



**The Choices We Make** There's no question that we live in a special place. The question is: Can it last? We think so, but only if we come to understand the relationship between the choices we make, both as individuals and as a society, and our environmental quality, and make environmentally smart decisions about our future.

And it's already happening: Florida's *Preservation 2000* land acquisition program has acquired hundreds of thousands of acres of sensitive lands, and will continue to spend \$300 million per year for the next ten years. North Carolina's recently established *Clean Water Management Trust Fund* is beginning to do the same thing in that state. In 1998, Tennessee passed land-

mark growth management legislation. Alabama recently passed a \$111 million bond for acquiring and managing parks. And in Georgia, the governor championed and the legislature passed legislation creating a regional transit authority for the 13-county metropolitan Atlanta area, to address its congestion

and air pollution problems.

The private sector also has its share of success stories. Developments that minimize stormwater runoff by minimizing roads and other impervious surfaces are gaining currency in the marketplace. *Seaside* (Florida), one of the first such

developments, now shares its town center design with dozens of environmentally friendly developments across the region. Developers are discovering that designing towns for people, rather than cars, can be more profitable than sprawling development, because it minimizes infrastructure costs.

A growing recognition that air and water quality are *land use* issues is beginning to serve parts of our region well. But we need to expand this awareness at all levels of government — particularly the county level, where most zoning decisions are made.

### **More than Protection, Conservation**

Numerous agencies and organizations are working hard to protect our remaining strongholds of biological diversity, conserve and restore impacted habitats, and educate the public about the value of natural resources. Programs such as The Nature Conservancy's *Rivers of Life* and the World Wildlife Fund's *Living Planet Campaign* have targeted Southeastern rivers and watersheds for conservation and public education. Other non-governmental organizations (NGOs) such as *Partners in Flight* and the newly established *Partners in Amphibian and Reptile Conservation* work with governmental agencies, academic institutions, other NGOs, and the public to promote research, conservation, and education about these fascinating species, their life histories, and their habitats.

Of equal importance to conservation are the grassroots initiatives in our own neighborhoods. Organizations across the region are working to preserve small, but critical pock-





ets of biological importance in our own backyards. These efforts are helping to maintain linkages between native habitats throughout the region.

**Local Land Conservation** National organizations operate many strong programs in the Southeast, but the local land trust community in our region is immature compared to its counterparts elsewhere and, as a result, has protected less land. However, land conservation is a growing priority in the Southeast, and between 1988 and 1998, the number of local trusts nearly doubled. Land trusts are nonprofit membership corporations whose mission involves land conservation. In contrast to large, well known national organizations such as The Nature Conservancy and The Trust for Public Land, most local land trusts are small, community-based organizations focused on protecting locally or regionally important resources. Many are all-volunteer organizations, and most operate with modest staffing levels. Conservation easements are their most popular tool, and many work as partners with state and local governments, acquiring land and transferring it to public agencies for management.

SENRLG's *Southeastern Ecological Framework*, a network of "hubs" and "corridors," will help state and local partners decide where to acquire open space that preserves connections between important natural areas. Ecological "hubs" are areas of high biotic diversity and low fragmentation found in wildlife refuges, national and state forests and parks, and private protected lands.

Open space "corridors" connect the hubs and typically follow natural land and water features, such as rivers and ridges.

**Each of Us Has a Role to Play** Significant amounts of pollution are generated by the burning of fossil fuels, which provide the bulk of the electrical energy used in the Southeast. If we take steps to conserve electrical energy at home and in our workplaces, we reduce the amount of coal that must be burned to meet demands, and thereby prevent pollution *at the source* (that is, the power plants).

Recycling and re-using paper, glass, plastics, and aluminum remains perhaps the single most effective method by which consumers can prevent pollution. Recycling reduces the amount of waste that must be disposed of in landfills and incinerators, which are potential sources of air and water pollution. In addition, manufacturing new items usually requires much more energy than producing the same items from recycled materials. For example, it takes as much as 10 times more energy to manufacture a new aluminum can as it takes to manufacture one from recycled aluminum. As consumers, we can also support recycling by purchasing, whenever possible, products that are themselves made from recycled materials.

Much progress has been made in our region in the area of pollution prevention, but there are still many opportunities for expanding those types of practices, and making them an integral part of our natural resource environmental protection efforts in the Southeast.

## Local Land Conservation\*

	Number of Land Trusts	Total Acres Protected	% Total State Acreage
Alabama	3	31,472	.09
Florida	29	56,839	.15
Georgia	23	7,646	.02
Kentucky	9	2,997	<.01
Mississippi	1	2,973	<.01
N. Carolina	22	37,741	.10
S. Carolina	14	29,749	.15
Tennessee	13	23,637	.09
Virginia	16	132,953	.50

\*Does not include lands owned by state and federal governments.

## Indicator Sources

**Pg. 7** *Number of Threatened and Endangered Species*  
Source: U.S. Fish and Wildlife Service ECOS Database (as of Aug. 2000)

**Pg. 9** *Wetland Losses*  
Source: Hefner, J.M., et. al., 1994. Southeast Wetlands: Status and Trends, Mid-1970s to Mid-1990s. U.S. Fish and Wildlife Service.

**Pg. 10** *Age-Adjusted Mortality Rates – All Cancers*  
Source: U.S. Centers for Disease Control and Prevention, National Center for Health Statistics, Vital Statistics Data, Cause of Death 1996.

**Pg. 16** *Unpermitted or Abandoned Hazardous Waste Sites Currently Under Investigation for Cleanup*  
(as of Sept. 7, 2000)  
Source: U.S. Environmental Protection Agency CERCLIS Database

**Pg. 17** *Pounds of Toxic Chemicals Released into the Environment in 1998 by Regulated Facilities*  
Source: U.S. Environmental Protection Agency, Toxic Release Inventory Database

**Pg. 24** *Vehicle Miles Traveled for Selected Southeastern Cities*  
Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics 1997.

**Pg. 25** *Areas That Violated the Ozone Standard in 1999*  
Source: U.S. Environmental Protection Agency Region 4, AIRS Database

**Pg. 40** *Pesticide Application Rates*  
Source: Kellogg et. al. July 1997 (revised Oct. 1997). "Potential Priority Watersheds for Protection of Water Quality from Nonpoint Sources Related to Agriculture." USDA, Natural Resources Conservation Service.

**Pg. 43** *Loss of Prime or Unique Farmland (1982-1992)*  
Source: Sorenson et. al. 1997. "Farming on the Edge." American Farmland Trust.

**Pg. 48** *Imperiled Aquatic Species*  
Source: U.S. Fish and Wildlife Service ECOS Database (as of Oct. 2000)

**Pg. 49** *River Miles Too Polluted for Support of Desirable Fish, Shellfish, and Other Aquatic Life*  
Source: U.S. Environmental Protection Agency, 1998 National Water Quality Inventory.

**Pg. 52** *Fish Consumption Advisories*  
Source: U.S. Environmental Protection Agency, 1999 National Listing of Fish and Wildlife Advisories.

**Pg. 57** *Shellfish Bed Closures*  
Source: National Oceanic and Atmospheric Administration, 1995 National Shellfish Register.

**Pg. 59** *Percent Resident Population Growth for Selected Coastal Counties (1982-1997)*  
Source: Based on county population data from U.S. Census Bureau Database

**Pg. 75** *Local Land Conservation*  
Source: Land Trust Alliance, 1998 National Land Trust Census Findings.



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## Agency Web Sites

Southeast Natural Resource Leaders Group	<a href="http://www.rgaatl.er.usgs.gov/srnrl.html">http://www.rgaatl.er.usgs.gov/srnrl.html</a>
The SENRLG Southeastern Ecological Framework	<a href="http://www.geoplan.ufl.edu/epa/index.html">http://www.geoplan.ufl.edu/epa/index.html</a>
U.S. Environmental Protection Agency, Region 4	<a href="http://www.epa.gov/region4/index.html">http://www.epa.gov/region4/index.html</a>
The Tennessee Valley Authority	<a href="http://www.TVA.gov">http://www.TVA.gov</a>
U.S. Army Environmental Center	<a href="http://aec.army.mil">http://aec.army.mil</a>
U.S. Fish and Wildlife Service	<a href="http://southeast.fws.gov">http://southeast.fws.gov</a>
Natural Resources Conservation Service	<a href="http://www.nrcs.usda.gov">http://www.nrcs.usda.gov</a>
National Park Service	<a href="http://www.nps.gov">http://www.nps.gov</a>
U.S. Forest Service	<a href="http://www.r8web.com">http://www.r8web.com</a>
U.S. Geological Survey	<a href="http://www.usgs.gov">http://www.usgs.gov</a>

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